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30th Annual

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Instruction Seminar

August 25, 26, 27, 28, 29, 1952

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TUESDAY MORNING — AUGUST 26	
(E) 8:30-9:20 A.M. Present Status (Experimental) of Ultrasonics — F. Krusen	
WEDNESDAY MORNING — AUGUST 27	
(F) 8:30-9:20 A.M. Electromyographic Studies in Poliomyelitis — Knowlton	
THURSDAY MORNING — AUGUST 28	
(G) 8:30-9:20 A.M. Research Methodology — Lion	
FRIDAY MORNING — AUGUST 29	
(H) 8:30-9:20 A.M. Effects of Age on Physiologic Function and Its Implications in Rehabilitation — Thewlis	

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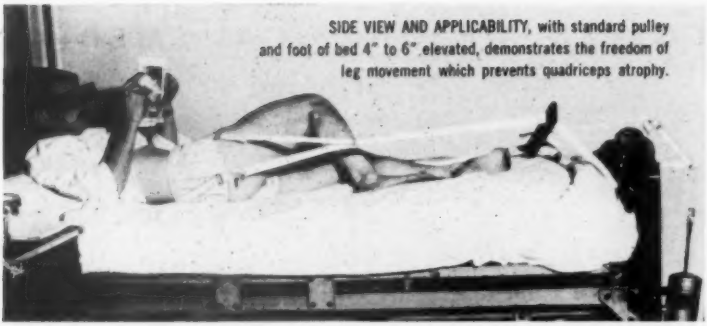

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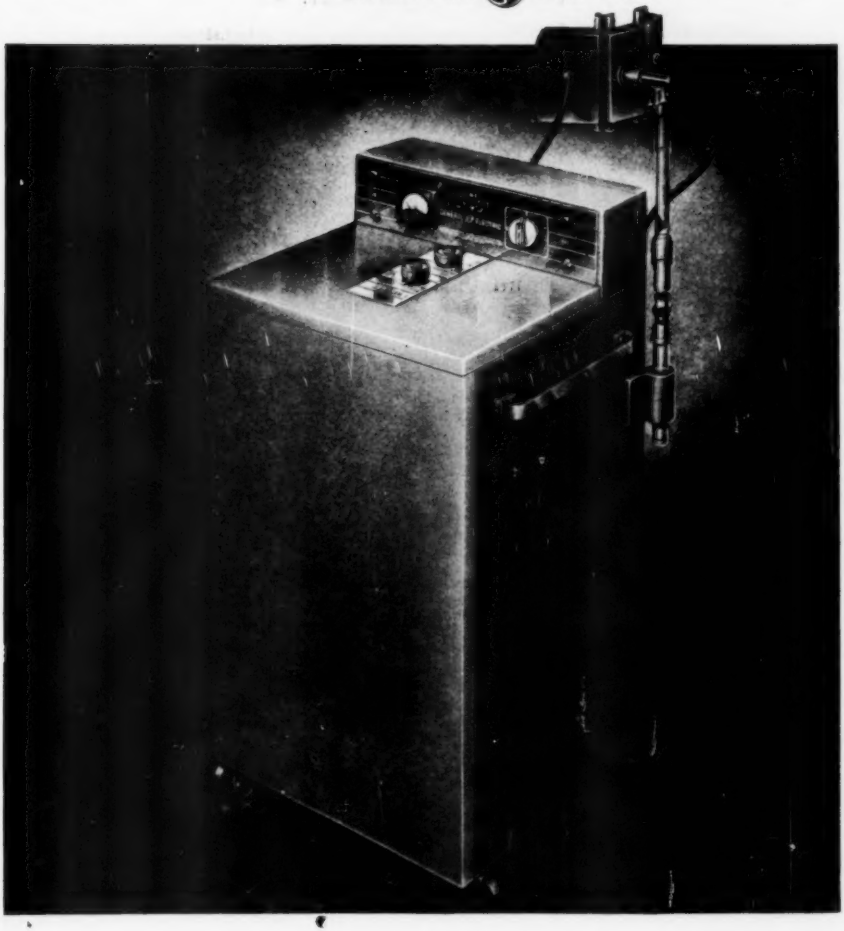

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INFLUENCE OF THE PITUITARY-ADRENAL AXIS ON THE HEMOGRAM OF FEBRILE WHITE RATS *

WILLIS L. HUBLER, M.D.
GEORGE M. HIGGINS, Ph.D.
and
J. F. HERRICK, Ph.D.

(With the Technical Assistance of Mary J. Woods, and Glen Christensen)

ROCHESTER, MINN.

It has been known for many years that fever produces certain characteristic changes in the leukocytic pattern of the peripheral blood of man and of experimental animals. In 1935 Hargraves, Doan and Kester[1] studied these changes in rabbits in which they had induced temperatures up to 109.8 degrees F. using the Kettering hypertherm or the radiotherm. They observed early leukopenia, followed five to seven hours later by leukocytosis. This was mainly a polymorphonuclear response consisting largely of young forms, and was interpreted as a delivery of immature cells from the bone marrow into the circulation.

A review of the recent literature has emphasized the similarity of such leukocytic changes following hyperpyrexia to those which follow a variety of alarming stimuli or exogenous ACTH or 11-17 oxysteroids.[2-5] These reactions have been accepted as circumstantial evidence that the characteristic hematopoietic response to hyperpyrexia may be mediated through the anterior pituitary gland and the adrenal cortex. It was the purpose of this study to subject this concept to direct investigation.

Experimental Methods

Since it was necessary to restrain all animals in a suitable cage, in order to expose them satisfactorily to the microwaves, it was essential that the changes in the blood categories induced by cage restraint, per se, be recorded. Freely flowing blood samples were obtained by cutting either the left or the right lateral tail vein, after the organ had been immersed in warm water. Using the United States Bureau of Standards pipets, the total leukocyte counts and the total eosinophilic leukocyte counts per cubic millimeter of blood were determined. The total eosinophilic leukocyte distributions were computed according to a modification of the Dunger technique,[6] using the Fuchs-Rosenthal counting chambers. By means of suitably stained smears, the absolute numbers of neutrophilic polymorphonuclear leukocytes and the

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* Abridgment of thesis submitted by Dr. Hubler to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Medicine.

* Read at the Meeting of the American Congress of Physical Medicine, Denver, Colo., Sept. 8, 1951.

* From the Division of Experimental Medicine, Mayo Foundation, University of Minnesota, Rochester, Minnesota.

1. Hargraves, M. M.; Doan, C. A., and Kester, L.: The Physiological Response of the Hematopoietic Tissues to Artificially Induced Fever. Abstracts of Papers and Discussions, Fifth Annual Fever Conference, Dayton, Ohio, 1935, pp. 51-59.
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3. Dalton, A. J., and Selye, H.: Blood Picture During Alarm Reactions, Folia Haemat. 62:397, 1939.
4. Dougherty, T. F., and White, A.: Influence of Hormones on Lymphoid Tissue Structure and Function. Role of Pituitary Adrenotrophic Hormone in Regulation of Lymphocytes and Other Cellular Elements of Blood, Endocrinology 36:1 (July) 1944.
5. Sayers, George: The Adrenal Cortex and Homeostasis, Physiol. Rev. 30:241 (July) 1950.
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absolute numbers of mononuclear leukocytes per cubic millimeter of blood were determined.

Animals which were selected for heating experiments were always trained for a period of days by confining them in plastic cages (fig. 1) in which they would later be subjected to the microwaves. This training, wherein animals were restrained for one hour daily, with rectal thermistors in place, continued

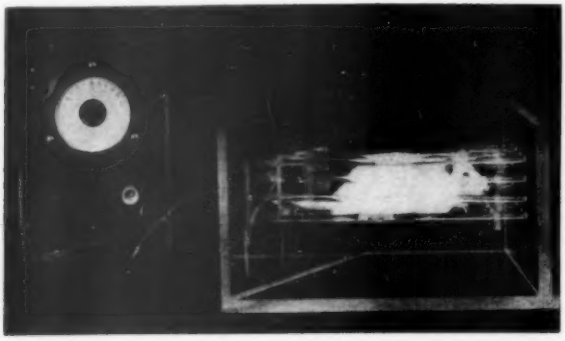

Fig. 1. — The plastic cage, the animal in place and the temperature recording device.

for a week or ten days. Such training always minimized those blood changes which fright or emotional disturbances invariably incite.

At 8:00 a. m. on the day following a satisfactory training period, samples of blood were obtained from the tail vein, and control data on the blood categories were established. Each animal was placed in its restraining cage, the rectal thermistor was inserted, and the animal was placed within the field

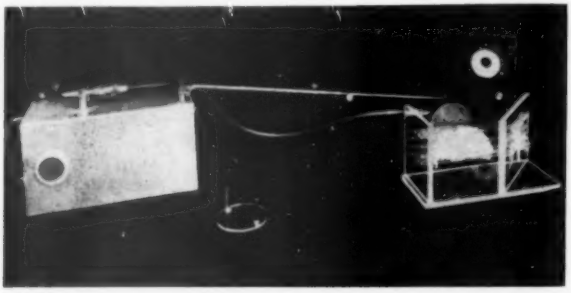

Fig. 2. — The Raytheon microwave apparatus, and the manner in which heat was applied.

of the Raytheon microwave machine (fig. 2) for one hour. The output of this machine was so regulated as to maintain a rectal temperature ranging from 41.0 degrees to 41.5 degrees C. Heating and cooling curves were established (fig. 3).

Blood samples were obtained immediately after heating, and at one, two, four, six, ten, twenty-four and forty-eight hours thereafter. Blood samples

were also obtained at corresponding intervals after the animal had been caged for one hour. Normal intact animals, adrenalectomized animals, hypophysectomized animals, hypophysectomized-adrenalectomized animals and adren-

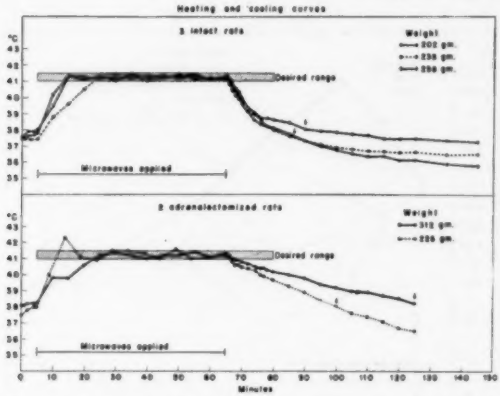

Fig. 3. — Heating and cooling curves of 3 intact rats and of 2 adrenalectomized rats.

al-demedullated animals with and without the exposure to microwaves were studied.

Results

I. *The Eosinophilic Leukocyte Response.* — Data assembled on the changes in the distribution of the eosinophilic leukocytes of animals subjected to caging alone, and to caging together with the influence of microwaves, are portrayed in figures 4, 5 and 6. Simple confinement within the restraining cage

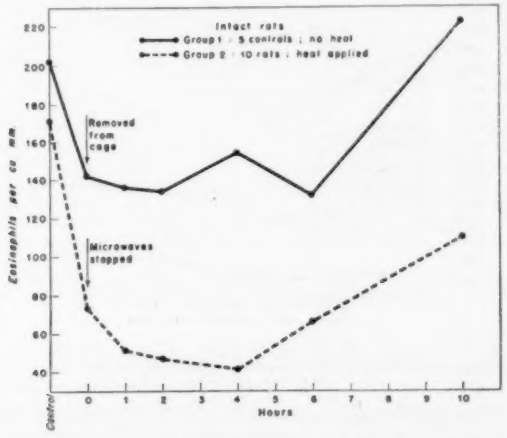

Fig. 4. — Changes in the eosinophil distributions of rats which were caged for one hour, and of rats which were caged and heated for one hour.

for one hour induced considerable eosinopenia, which persisted for at least six hours. Normal levels had been restored when the blood was sampled ten hours after the rats had been removed from their cages (fig. 4). But when heat was applied to these same animals confined in the same cages these

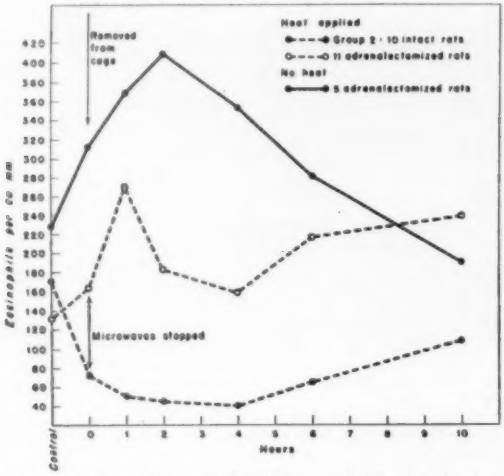

Fig. 5. — Changes in the eosinophil distributions of intact and adrenalectomized heated rats, and of adrenalectomized rats which were caged but not heated.

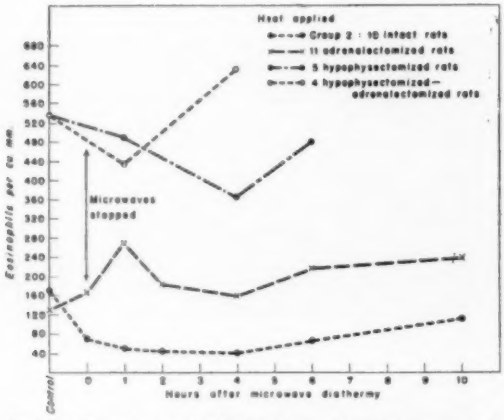

Fig. 6. — Changes in the eosinophil distributions of intact, adrenalectomized, hypophysectomized and hypophysectomized-adrenalectomized rats caged and heated for one hour.

changes were all greatly accentuated, indicating a far greater response by the mechanism which controlled the eosinophilic level in the peripheral blood. The greatest decline in the number of eosinophils occurred at four hours after

the exposure to the microtherm (fig. 4), and normal values were not restored ten hours after exposure.

When the adrenal glands were removed and these animals were maintained on a high salt intake, the changes (fig. 5) in the eosinophil levels of animals which were caged only, and of those which were caged and subjected to microwave therapy for one hour, differed markedly from the changes in intact animals (fig. 4). In the absence of the adrenal glands both cage re-

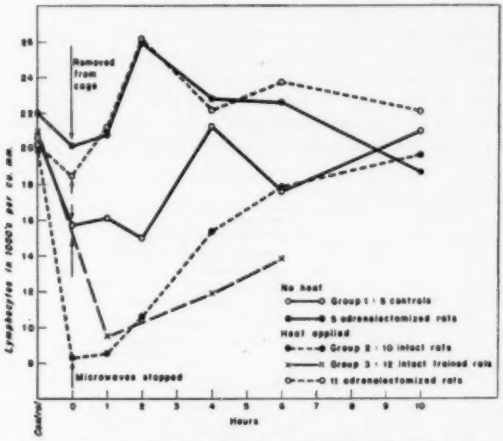

Fig. 7. — Changes in the lymphocyte distributions of intact and adrenalectomized rats with and without the applications of heat.

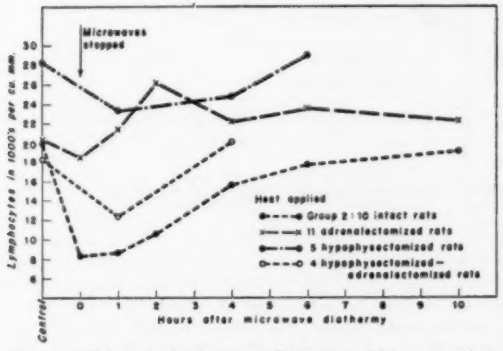

Fig. 8. — Changes in the lymphocyte distributions of intact, adrenalectomized, hypophysectomized and hypophysectomized - adrenalectomized rats caged and subjected to heat for one hour.

striction and cage restriction plus the application of heat induced eosinophilia rather than eosinopenia. Reasons for this elevation in the eosinophil count, under the impact of either cage restriction or restriction plus heat, are not clear; but it may represent a discharge into the peripheral circulation of cells temporarily sequestered in various organs.

The changes in the eosinophil distributions incited by heat in normal intact animals, in adrenalectomized animals, in hypophysectomized animals and in hypophysectomized - adrenalectomized animals are shown in figure 6. In our experience eosinophil levels range very much higher in hypophysectomized animals than in normal animals, although the spread of the data is greater. When heat was applied to hypophysectomized animals we obtained, four hours later, eosinopenia of far less magnitude than that recorded when intact animals were heated. This may be a real eosinopenia and, if so, may well be explained by a direct effect on the atrophic adrenal cortex, thereby releasing minimal amounts of adrenal steroid, which in turn exerted some eosinophilolytic changes. The curve setting forth the changes induced by heat after both hypophysis and adrenal glands were removed (fig. 6) shows a slight decline at one hour, a decline which was statistically insignificant; but at four hours, the eosinophil level was statistically significantly higher and thereby resembled data hitherto assembled on the adrenalectomized animals.

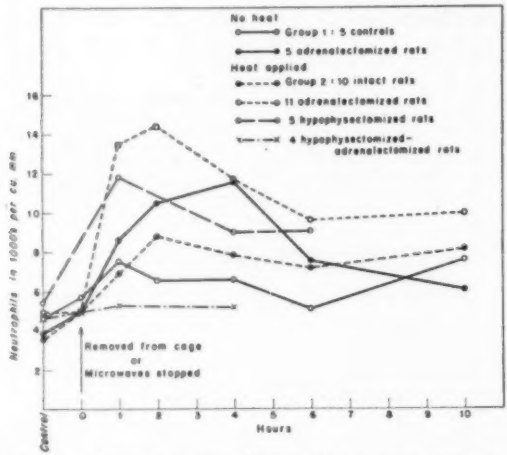

Fig. 9. — Changes in the neutrophil distributions of intact, adrenalectomized, hypophysectomized, and hypophysectomized-adrenaleectomized rats with and without the application of heat.

II. *The Mononuclear Leukocyte Response.* — The changes in the lymphocyte (including all mononuclear leukocytes) distributions in the various animals subjected to cage restriction, and to cage restriction plus the application of heat, were not unlike those changes observed for the eosinophilic leukocytes. Cage restrictions, per se, always incited lymphopenia; but when the stimulus of the heat was superimposed, the degree of lymphopenia was much greater (fig. 7). This is due, we presume, to the lymphocytolytic effects induced by the increased adrenal function incited by the stress which either caging alone, or caging plus heat, had placed on the organism. When animals were adrenalectomized and comparable stress was applied — either caging alone or caging plus heat — lymphopenia did not occur in either group (fig. 7).

When heat was applied to the hypophysectomized animals, lymphopenia did occur (fig. 8). It was transient, however, and normal distributions were

recorded six hours after heating. As in the eosinopenic response, it is presumed that sufficient adrenal cortex persisted, following loss of the pituitary gland, to put out sufficient steroid hormone to incite this minimal, transient lymphopenic response. However, real lymphopenia occurred in the 4 hypophysectomized animals which were later adrenalectomized. At present we have no explanation for this change, but we believe it may be dependent on adrenal accessories. This observation should be repeated on a larger number of animals to make certain of this trend.

III. *The Polymorphonuclear Leukocyte Response.* — The peripheral distributions of the neutrophilic leukocytes in animals subjected to caging, and in those subjected to caging and to heat, are condensed and shown graphically (fig. 9). Neutrophilia occurred in all animals following either caging for one hour, or caging with added heat for one hour, except in those which had been both hypophysectomized and adrenalectomized. The degree of neutrophilia was even greater in the adrenalectomized rats subjected to heat than in the intact animals subjected to the same temperature. Both ACTH and cortisone have been shown to produce neutrophilia. In intact animals subjected to heat, it is presumed that both ACTH and cortisone were released and that both hormones exerted their effect; and yet the degree of neutro-

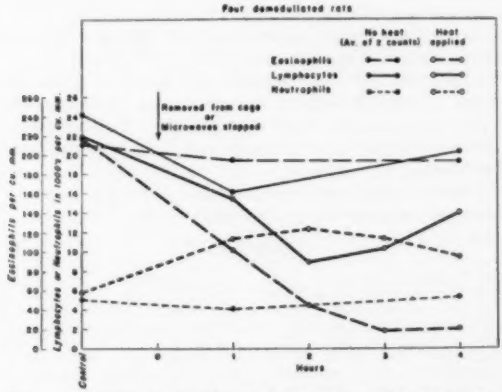

Fig. 10. — Changes in the eosinophil, lymphocyte and neutrophil distributions in 4 adrenal-demedullated rats, with and without the application of heat.

philia was greater in those animals which were without adrenal cortices than in the intact animals. Whether larger amounts of ACTH were released by the pituitary glands in adrenalectomized animals than in intact animals remains to be demonstrated. In animals without their pituitary glands, neutrophilia followed the application of heat to a degree nearly as marked as that which followed when adrenalectomized animals were heated to the same temperatures. When animals were without both adrenal glands and pituitary glands, then, and then only, did neutrophilia fail to occur.

IV. *The Response in Demedullated Animals.* — To test the role of the adrenal medulla in the sequence of events which incite changes in these various blood categories following heating, we enucleated both adrenal glands in a small series of animals, thereby removing all medullary tissue, the source

of epinephrine. After recovery these animals were subjected to heat in exactly the same manner as before, and the blood categories were examined at the corresponding intervals thereafter. Data are portrayed in figure 10. It seems clear that the changes observed were comparable to those described in normal intact anmals. However, caging per se did not appear to exert quite the degree of response in the adrenal-demedullated animal as was shown to occur in the intact animal. Caging induced neither eosinopenia nor neutrophilia, although lymphopenia did occur. However, when these same animals were caged and heated, marked eosinopenia, marked lymphopenia and marked neutrophilia did occur. It would appear that the adrenal medulla may function in the train of events which occurs within the organism after mild stress. But when stress was accentuated, as in heating, the adrenal medulla was not essential to the systemic reactions which ensued.

Conclusions

1. Hyperthermia induced a characteristic hematologic picture in intact male rats. This consisted of eosinopenia, lymphopenia and neutrophilia.

2. Hyperthermia did not incite eosinopenia or lymphopenia in adrenalectomized rats. Therefore it is postulated that these trends, when observed in intact animals, indicate adrenocortical stimulation.

3. Hypophysectomized rats showed the same trends following hyperthermia as intact animals. Quantitatively, however, the eosinopenia and lymphopenia were much less. It may well be that the high temperatures stimulated adrenal secretion even in the absence of the pituitary.

4. Since hyperthermia was capable of inciting neutrophilia in either adrenalectomized or hypophysectomized but not in hypophysectomized-adrenalectomized animals, it is postulated that either adrenocortical hormone or pituitary hormone had induced the outpouring of neutrophilic leukocytes into the peripheral blood.

5. The adrenal medulla was not essential to the production of the characteristic hematopoietic response to elevated body temperature.

Discussion

Dr. Frederic T. Jung (Chicago): This paper deserves commendation because it deals with a problem of general physiological interest, namely, the association of a certain type of hemogram with fever, because it deals with the timely problem of the action of ACTH and cortisone; and because controls have been used to eliminate the effects, for instance, of restraint of the experimental animals.

In Fig. 9, attention is called in the accompanying remarks to the fact that the number of animals used in the hypophysectomized - adrenalectomized group was small, and that "one would hesitate to rely too heavily" on the unexpected and unexplained findings that are reported there.

The double operation must be a severe strain upon the organism, and one wonders whether hypophysectomized - adrenalectomized animals are capable of reacting to any sort of stimulus as vigorously as animals upon which no operation had been performed. It would be worthwhile to state how long a time had elapsed after completion of the second stage of the double operation, and to describe the general condition of the animals.

One way to "control" this aspect of the work would be to use sham operations, in which the control animals would be subjected to all the anesthetic and surgical trauma of the two extirpation operations, while leaving the organs in situ.

EFFECT OF MASSAGE ON MUSCLE TEMPERATURE AND RADIOSODIUM CLEARANCE *

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and

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History

Massage has been known and practiced by members of the healing profession since ancient times. In the Indian Vedas,[1] which are believed to have their origin about 1800 B. C., references are made to procedures which can readily be interpreted as forms of massage carried out for therapeutic purposes. Notwithstanding this background in antiquity, it was not until the latter part of the nineteenth century that attempts were made to investigate the effects of massage scientifically. Apparently the first physiologic experiment to determine the value of this procedure was performed by von Mosengeil[2] in 1876, who injected India ink into knee joints of rabbits and then massaged these joints. He found that the ink was dispersed into adjacent tissues, and drew the conclusion that massage had a beneficial effect upon the resorption of inflammatory products in the joint. This same worker also postulated the salutory effects of massage upon the venous circulation,[3] and also was the first to show that massage produced a rise in temperature of the treated skin of 0.25 to 3 degrees centigrade.[4]

In 1877 Lassar[5] demonstrated that lymph flow was influenced by massage. He inserted a glass cannula into a lymph trunk of a dog's leg and determined the normal rate of flow to be a mere drop in ten minutes, while with massage it was possible to collect a few cubic centimeters of lymph with great ease and within a short period of time. He showed further that in an inflamed leg the flow of lymph was greater than normal and was further augmented by massage.

In the following decade Zabludowski[6] carried on extensive investigations in an attempt to evaluate the effect of massage. His work was not held in high esteem by his contemporaries. His experiments were apparently done in a careless manner and his conclusions were based on inadequate and poorly controlled observations. Zabludowski studied the effect of massage on body weight, muscle power, body temperature, pulse rate, respiratory rate, urine volume, urinary nitrogen, phosphorus and sulfur excretion, blood pressure, and on the number of daily bowel evacuations.

Eccles[7] in 1885 showed that the effects of body massage varied with the location of the massage. Treating the trunk and extremities for 30-45 min-

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† From the Physical Medicine and Rehabilitation Service, and the Radioisotope Unit, Bronx Veterans Administration Hospital.

‡ Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are a result of their own studies and do not necessarily reflect the opinion or policy of the Veterans Administration.

1. Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung. Berlin, 1910, p. 1.
2. von Mosengeil: Ueber Massage, deren Technik, Wirkung, und Indikationen. Arch. f. klin. Chirurgie, 19, No. 3 and 4, 1876.
3. von Mosengeil, op. cit.
4. von Mosengeil, op. cit.
5. Lassar, O.: Ueber Oedem und Lymphstrom bei der Entzuendung. Virch. Arch. 69:513, 1877.
6. Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung. Berlin, 1910, p. 2.
7. Eccles, A. S.: Observations on Physiological Effects of Massage. Proc. Roy. Soc. Med., London, 1885-87.

utes produced a rise in surface temperature and a fall in rectal temperature; but massaging the abdomen had the reverse effect. Rosenthal[8] investigated these results further and came to the conclusion that any increase in skin temperature was largely the result of friction and was not caused by increased circulation. He also showed that the elevation in skin temperature was very fleeting, since it fell to almost pre-treatment level within thirty seconds.

Physiologic Basis

The earliest investigations of the physiologic effects of massage upon muscle were carried out by Zabludowski,[9] whose primary contribution lay in establishing its beneficial effect upon muscle fatigue. In his experiments a muscle was completely fatigued by electric stimulation, and was then either rested or massaged for a period of ten minutes. The threshold of excitability was always lower in the massaged muscle. He interpreted this as being due to speeding up of the circulation, which thereby aided in the more rapid removal of so-called fatigue substances such as carbon dioxide and lactic acid. This explanation was challenged by Maggiore,[10] who showed that massage of rested muscle also increased its activity and energy. He believed, therefore, that the effect could not be attributed to the removal of fatigue substances, but was probably the result of the augmented circulation per se. This was further substantiated by Hans Ruge[11] in 1903 in his studies of the effect of massage on the work capacity of muscle with circulation intact, as compared to muscle deprived of its circulation. He found that after fatiguing exercise a muscle with intact circulation was able to perform 80 per cent more work after massage than following a period of rest of equal duration. The muscle without circulation reacted similarly during the early period of the experiment, but then became weaker through massage than the muscle treated only with simple rest. These results were interpreted to indicate the need for an intact circulation to permit the beneficial effects of massage.

On theoretical grounds von Mosengeil[12] postulated in 1876 that massage increases the circulation to the massaged part. He argued that since massage causes a more rapid emptying of the venous and lymphatic circulation of the massaged part, the blood must of necessity be replaced by an increased blood flow in the arterial circulation supplying that part. As mentioned earlier, Lassar demonstrated a marked increase in lymph flow in dogs following massage and inflammation. Zabludowski, using a crude arm plethysmograph, was able to demonstrate increased blood flow in a forearm contained in the plethysmograph while massaging the other arm, or even a lower extremity. Lehmann[13] in 1899, using improved techniques, showed that psychologic factors alone were able to produce variations in the volume of the forearm and thereby cast doubt on Zabludowski's claims regarding the effect of massage on blood flow. Rosenthal[14] later showed by more refined instruments that the volume of an arm completely fatigued by exercise dropped to normal almost immediately, while this reduction in limb volume was delayed by massage.

The first direct measurements of the effect of massage upon blood flow were carried out by Friedel Pick.[15] By repeated phlebotomies he defibrinated

8. Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung. Berlin, 1910, p. 18.
9. Zabludowski, J.: Quoted by Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung, Berlin, 1910, p. 36.
10. Maggiore: Quoted by Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung, Berlin, 1910, p. 40.
11. Ruge, H.: Physiologisches ueber Muskelmassage nebst einigen therapeutischen Bemerkungen, Zeitschr. f. physikal. u. diet. Therapie, 1902/3, No. 3.
12. von Mosengeil: Ueber Massage, Arch. f. klin. Chir. 19: No. 3, 1876.
13. Lehmann: Quoted by Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung, Berlin, 1910, p. 55.
14. Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung, Berlin, 1910, p. 56.
15. Pick, F.: Verhandlungen des Kongresses fuer Innere Medizin, XX, Wiesbaden.

the entire blood content of experimental dogs. He then inserted a cannula into the femoral vein, which was connected to a calibrated burette by means of which he was able to measure the time required for a stated amount of blood to flow through the femoral vein. He found that effleurage caused a decided increase in venous blood flow of the massaged extremity, which effect lasted only during the period of massage. In contrast, tapotement not only caused a similar increase in blood flow, but this increased flow was maintained for a considerable period after massage had been stopped. The same results were obtained with petrissage. He concluded from these experiments that effleurage produced increased venous blood flow through mechanical means, whereas tapotement and petrissage caused an increase in blood flow through reflex dilatation of the vessels of the massaged muscle and skin.

At the present time there is no satisfactory method of determining muscle blood flow in man directly. In 1939 Mayerson and Toth[16] used a specially constructed thermocouple, consisting of a long steel needle with insulated shaft, with which they recorded temperatures of the subcutaneous tissues and muscle. The following year the same technique was used by Friedlander, et al.[17] to determine the effect of various drugs and procedures upon skin and muscle blood flow simultaneously, stating that an increase in muscle temperature reflected increased circulation.[18] This claim has not been entirely accepted, since under certain conditions other factors might be responsible for the increased temperature, cutaneous vasoconstriction might prevent loss of some of the heat arising in muscles, and alterations in muscle metabolism could conceivably affect the rate of heat production without altering the circulation to the same degree. More recently the rate of clearance of radioactive sodium from the tissues has been used as an index of circulation.[19] While this method is still in the experimental stages, and is not universally accepted, the authors believe that it does adequately measure effective blood flow in tissues.[20] One of the objections to the method is that spasm of vessels may occur as a result of the injection.[21] In our experience such spasm does not last longer than four to six minutes, and readings of the activity recorded for this time interval are compensated in plotting the curve.[22] Another criticism of this technique recently published[23] is not considered valid, since the authors in their studies neglected to take off background readings, did not consider the possibility of vascular spasm, and recorded activity for only ten minutes which may give entirely false results. Furthermore, these investigators used needles two centimeters in length, which will not reach muscle in many subjects of robust physique.

In our studies of the effect of massage upon muscle blood flow we have used both of these methods in an attempt to determine the value of massage as a therapeutic procedure for increasing circulation in muscle. Bierman,[24] using the thermocouple technique, has found evidence that circulation in muscle is increased, but he gives no quantitative data. It was our purpose

16. Mayerson, H. S., and Toth, L. A.: The Influence of Posture on Skin and Subcutaneous Temperatures, Am. J. Physiol. **125**:474, 1939.
17. Friedlander, M.; Silbert, S., and Bierman, W.: Regulation of Circulation in Skin and Muscles of the Lower Extremities, Am. J. Med. Sc. **199**:657, 1940.
18. Friedlander, M.; Silbert, S.; Bierman, W., and Laskey, N.: Differences in Temperature of Skin and Muscles of the Lower Extremities Following Various Procedures, Proc. Soc. Exp. Biol. & Med. **38**: 150, 1938.
19. Kety, S. S.: Measurement of Regional Circulation by the Local Clearance of Radioactive Sodium, Am. Heart J. **38**:321, 1949.
20. Wisham, L. H.; Yalow, R. S., and Freund, A. J.: Consistency of Clearance of Radioactive Sodium from Human Muscle, Am. Heart J. **41**:810, 1951.
21. Mufson, I.: Response of the Abnormal Arterial Circulation to Various Stimuli, as Studied by the Use of Radioactive Sodium, Ann. Int. Med. **34**:428, 1951.
22. Wisham, L. H., and Yalow, R. S.: Some Factors Affecting the Clearance of Na^{24} From Human Muscle, Am. Heart J. **43**:67, 1952.
23. Miller, H., and Wilson, G. M.: The Measurement of Blood Flow by the Local Clearance of Radioactive Sodium, Brit. Heart J. **13**:227, 1951.
24. Bierman, W.: Physical Medicine in General Practice, 2nd Ed., Hoeber, New York, 1947.

in this study to determine, if possible, the degree to which circulation can be augmented by massage alone.

Method I. Muscle Temperature

Ten test subjects were used, all being patients in a general medical-surgical hospital. All patients were free of any clinical evidence of peripheral vascular disease. The Leeds and Northrop multiple channel electric recording thermocouple "SPEEDOMAX" was used. One of the eight available leads was connected directly to a needle muscle thermocouple, and all leads used were tested for accuracy against known temperatures. The subject being tested was placed prone on a plinth. An area of skin over each calf, with its underlying subcutaneous tissue, was infiltrated with procaine. Skin thermocouples were then fastened on the skin of each calf immediately adjacent to the injection site, and the muscle thermocouple was inserted into the belly of the gastrocnemius muscle to be massaged through the anesthetised skin. The subject was permitted to rest until all temperatures were stabilized. The needle thermocouple was then withdrawn and inserted into the other calf muscle, while the skin thermocouple was removed from the calf which was to be massaged. A ten minute massage, using kneading and deep stroking, was then administered to the test calf. After the massage the muscle thermocouple was withdrawn from the nontreated side and immediately inserted into the massaged calf muscle. The skin thermocouple was re-applied to the massaged calf. Room temperature was recorded continuously, and mouth temperature, pulse, and blood pressure were recorded immediately before and after massage.

Method II. Radiosodium Clearance

The subjects for this part of the investigation were six males and one female, none of whom had clinical evidence of peripheral vascular disease. The subjects were permitted to lie supine for ten to fifteen minutes in a room in which the temperature was maintained between 75-80 degrees F. An injection of 0.1 cc. of isotonic sodium chloride solution containing between one and three microcuries of radioactive sodium (Na^{24}) was then made into the belly of the gastrocnemius muscle with a 20 gauge 1½ inch needle. The needle was inserted to the hilt.

A thin mica-window Geiger counter coupled to an automatic register was placed in position over the injection site and recordings of the radioactivity present were taken at intervals of two minutes for one hour. This procedure was done twice on every subject, once as a control, and a second time on the following day immediately after a ten minutes massage had been administered. Calculations of the clearance rates were then made as described in a previous report by one of the authors (LHW[25]). Results are expressed in clearance constants and in half-life. The half-life is the time required for the activity to reach half its initial value. The clearance constant is derived from the formula $K \text{ (clearance constant)} = \frac{0.693}{T\frac{1}{2} \text{ (half-life)}}$.

Findings

Of the ten subjects tested with the muscle thermocouple, five showed no change in muscle temperature on the massaged side. One of these five, however, showed a gradual rise of 0.7 degrees F. during the five minute period following conclusion of the massage. Of the remaining five subjects one

25. Wisham, L. H.; Yalow, R. S., and Freund, A. J.: Consistency of Clearance of Radioactive Sodium from Human Muscle, Am. Heart J. 41:810, 1951.

TABLE 1. — *Muscle Temperatures.*

#	NAME	DATE	ROOM TEMP.	ORAL TEMP.		BLOOD PRESSURE		PULSE		MASSAGED MUSCLE		NON-MASSAGED MUSCLE		MASSAGED SKIN		NON-MASSAGED SKIN		DURATION OF EFFECT (IN minutes)			REMARKS
				BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	MASSAGED MUSCLE	MASSAGED SKIN	NON-MASSAGED SKIN	
1	EC	1-3-51	76	98.6	98.0	138/90	136/90	72	68	95.0	95.0	96.3	96.0	89.3	92.0	87.3	87.0	—	1.5	—	
2	JM	1-4-51	76	99.0	98.6	130/70	130/68	80	78	98.3	98.5	99.0	99.0	91.0	92.5	92.5	94.5	20	2	1	
3	JD	1-4-51	76	98.2	97.0	126/90	140/98	92	88	97.5	97.0	97.5	97.7	95.0	95.5	95.0	94.0	—	10+	—	
4	CB	7-20-51	78	98.4	98.0	106/80	106/80	72	72	97.0	97.0	96.7	96.7	88.0	91.5	91.3	92.0	12	GRADUAL DECLINE OF TEMPERATURE OVER 7 MIN.	9	
5	SW	7-20-51	77.5	97.8	98.0	140/78	140/78	90	90	95.0	96.0	96.5	96.5	88.0	93.0	89.0	90.0	TEMP. ROSE TO 97.0 DURING NEXT 12 MINUTES	TEMP. ROSE TO 94.0 OVER 12 MIN. PERIOD	3	TEMPERATURE 97.0 AT COMPLETION OF TEST 15 MINUTES AFTER MASSAGE ENDED
6	AC	7-24-51	81	98.2	98.4	150/104	150/110	112	114	97.7	97.7	97.5	97.5	89.0	92.0	91.5	92.5	—	POST MASSAGE TEMPERATURE MAINTAINED 15 MINUTES	GRADUAL RETURN TO PRE-MASSAGE LEVEL IN 15 MIN	SKIN TEMPERATURE GRADUALLY RETURNED TO PRE-MASSAGE LEVEL OVER 16 MINUTE PERIOD
7	PM	7-24-51	81	98.6	98.6	112/70	110/74	84	84	94.3	95.0	98.5	96.5	88.5	92.0	88.0	88.7	9+	9+	9+	
8	AN	7-25-51	83	98.2	98.0	110/78	108/74	90	94	97.6	97.6	*		94.5	95.5	93.0	94.0	—	10+	8	*MUSCLE TEMPERATURES OF NON-MASSAGED SIDE DISCONTINUED BECAUSE OF NEGLIGIBLE EFFECT
9	LM	7-25-51	83	98.6	98.6	130/80	136/80	96	94	98.5	98.3			91.7	94.0	93.5	93.0	—	GRADUAL DECLINE TO PRE-MASSAGE LEVEL IN 75 MIN	—	
10	JH	7-26-51	83.5	98.4	98.4	116/60	110/60	84	84	98.0	98.0			94.3	96	92.0	93.0	—	9+	4	

TABLE I

showed a rise of 0.2 degrees, and one a rise of 0.7 degrees; one patient registered a fall in temperature of 0.2 degrees, and one a fall of 0.5 degrees. The one remaining subject showed an increase in muscle temperature of one degree F. immediately following the massage, and during the twelve minutes after conclusion of massage a gradual rise in muscle temperature of one additional degree took place. This rise was still evident when the test was concluded several minutes later.

The temperatures of the non-massaged calf muscles showed no remarkable changes except in one subject (Table 1) whose non-massaged calf muscle recorded a gradual two degree fall during the ten minute period while the other calf was being massaged.

With the radiosodium clearance method the tests showed no appreciable changes in blood flow following massage as compared to the control clearance. Two of the subjects showed a slight increase (Table 2) in effective blood flow, four of the subjects showed a slight decrease following massage, and one showed no change. However, all these changes are within the experimental error of the technique, variations from a mean figure being usually ± 20 per cent.[26]

TABLE 2. — *Radiosodium Clearance.*

Subject	—Clearance Constant (K) Min.$^{-1}$— Control	Post-Massage	——Half Life in Minutes—— Control	Post-Massage
1 FW	.0925	.1026	7.5	6.75
2 JL	.0867	.0840	8.0	8.25
3 BW	.0991	.0991	7.0	7.0
4 NB	.0991	.1108	7.0	6.25
5 MV	.0840	.0792	8.25	8.75
6 LW	.0867	.0792	8.0	8.75
7 AE	.0956	.0925	7.25	7.5

The changes found by us were all within these limits. It should be understood, however, that any increase in blood flow which might take place during massage would not be shown with this technique.

Other incidental findings, although not directly the object of this investigation, were the skin temperature changes. It was noted that the massaged skin showed considerable temperature elevations, ranging from a minimum rise of 0.5 degrees to a maximum of 6 degrees, the average being 2.5 degrees. It was also noted that the increase in temperature was maintained for a considerable period of time, from a low of 1½ minutes to a high of twelve plus minutes. This finding is at variance with the results reported by Rosenthal, who stated that the rise in temperature is very fleeting, lasting for some thirty seconds only. An effect was also noted upon the skin of the non-massaged calf. A moderate rise in temperature was observed to begin two to three minutes after massage of the opposite calf was begun. This rise was short-lived, lasting in most instances only four to five minutes, and averaging only 0.5 degree. The oral temperature showed minimal variations, as did the pulse rate. Blood pressure in one subject showed an increase of 14 mm. Hg. systolic, and in another 8 mm. Hg. systolic, with commensurate changes in the diastolic pressure; in all other subjects blood pressure readings before and after massage were within two to four millimeters of each other. (See Table 1.)

26. Wisham, et al., op. cit.

Conclusions

Massage is not an effective method for increasing blood flow to muscle as determined by muscle temperature studies and clearance of radioactive sodium from muscle. Only one subject out of ten showed any significant rise in muscle temperature following massage, and none of the subjects tested by the radiosodium technique showed evidence of increased muscle circulation as a result of massage.

The value of massage for increasing circulation to the skin is confirmed, and it was further established that the effect produced by massage is of longer duration than previously reported. A slight increase in skin temperature was also observed in the opposite limb, lasting for several minutes only, and probably reflex in nature.

Summary

Ten subjects were studied to determine the effect of massage upon muscle temperature, and seven subjects were studied to determine the effect of massage upon muscle blood flow by means of the radioactive sodium clearance technique. The results of these studies are presented.

The authors wish to thank Dr. K. Harpuder, Senior Consultant in Physical Medicine and Rehabilitation and Peripheral Vascular Diseases, Bronx Veterans Administration Hospital, for his advice and suggestions, and to Dr. Arthur S. Abramson, Chief, and Dr. Bernard Stoll, Assistant Chief, Physical Medicine Rehabilitation Service, Bronx Veterans Administration Hospital, for their guidance in the preparation and editing of this paper. Thanks are also due to Mr. Morris Vogel, Chief, and Mr. Larry Weinstein, Assistant Chief, Physical Therapy Section, Bronx VA Hospital, for the administration of the massage to the subjects who participated in this study, and to Miss Birdie Cooper for the preparation of the manuscript.

Discussion

Dr. Jerome Weiss (Brooklyn, N. Y.): This excellent paper by Drs. Ebel and Wisham represents a definite advance in our better understanding of the physiology of Physical Medicine. Its preparation has entailed a vast amount of work and it arrives at conclusions which would be difficult indeed to challenge. At first an impression is felt that the largely negative results shown constitute a lessening of the value of massage. It has repeatedly been stated by others that it is impossible to massage a muscle without also massaging the overlying skin. The skin contains highly sensitive receptor nerve ends. These nerve ends connect with both the central and the sympathetic nervous systems. It is difficult to localize the effects of massage, because of the widespread connections of the nervous system. Hence, increased blood flow becomes of minor importance in estimating the overall benefits of massage. The reflex value of massage is probably the most important of all. From this point of view, we may retain a conventional estimate of the merits of massage. The essayists have wisely avoided denial of these general benefits.

INCIDENCE OF PAIN IN IDIOPATHIC SCOLIOSIS

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Idiopathic scoliosis is generally recognized as a self-limiting deformity. In practically all cases the scoliosis stops progressing between the ages of 13 and 19 years or when the spinal column stops growing.[1-3] The equilibrium so established is then maintained or altered slightly according to the plasticity of the bone.[4] The chief concern of most physicians during this formative period is the resultant cosmetic deformity. Pain is a relatively insignificant factor during this period of growth. However, as these patients approach middle age many of them complain of backaches of varying severity and duration.

Very limited information can be gleaned from the extensive literature relative to the actual incidence of pain in idiopathic scoliosis. James[5] has stated that in a series of 353 patients, representing all types of scoliosis, 69 complained of pain and 59 had idiopathic scoliosis. In a review of 425 cases of idiopathic scoliosis in 1941 by the Research Committee of the American Orthopaedic Association[6] pain was mentioned as a chief complaint in only 8 per cent of the cases.

The present study was undertaken to determine (1) the incidence of pain in idiopathic scoliosis in various age groups, (2) the patient's age at the onset of pain, and (3) any possible correlation between the severity of the pain and the location and degree of the major curve.

Of 324 consecutive cases of all types of scoliosis of varying severity diagnosed by roentgenography at the Mayo Clinic during the first four months of 1941, 249 cases were judged to be idiopathic in origin and nature. All cases in which the patients were 50 years of age or more were discarded, since the incidence of other recognized causes of pain becomes quite high in this age group; this discarded group was composed of 126 cases of scoliosis, of which 94 were idiopathic. Of the remaining 155 cases of idiopathic scoliosis under the age of 50 years, 23 were discarded because they had concomitant conditions which are recognized causes of pain. The remaining 132 cases of idio-

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3. von Lackum, W. H.: Surgical Treatment of Scoliosis. In Bancroft, F. W., and Marble, H. C.: Surgical Treatment of the Motor-Skeletal System. Ed. 2, Philadelphia, J. B. Lippincott Company, 1951, pt. 1, pp. 152-216.
4. Steindler, Arthur: Diseases and Deformities of the Spine and Thorax. St. Louis, The C. V. Mosby Company, 1929, pp. 126-148.
5. James, J. E. P.: Two Curve Patterns in Idiopathic Structural Scoliosis, J. Bone & Joint Surg. 33B:389 (Aug.) 1951.
6. Report of the Research Committee of the American Orthopaedic Association: End-Result Study of the Treatment of Idiopathic Scoliosis, J. Bone & Joint Surg. n. s. 23:963 (Oct.) 1941.

pathic scoliosis under the age of 50 years were considered to have no other recognizable cause for pain and constitute the group of cases on which this study was based.

TABLE 1. — *Age and Sex Distribution of Patients Having Idiopathic Scoliosis, 1941.*

Age, Year	Both Sexes		Male		Female	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
10-19	14	10.6	4	7.4	10	12.8
20-29	25	18.9	8	14.8	17	21.8
30-39	38	28.8	16	29.6	22	28.2
40-49	55	41.7	26	48.2	29	37.2
Total	132	100.0	54	100.0	78	100.0
Per cent of total	100.0		40.9		59.1	

The age and sex distribution of the 132 patients studied is shown in table 1.

Eighty-six patients (65.2 per cent) complained of some degree of pain at the time of their examination in 1941. A much higher percentage of patients in the older age groups complained of pain than of those in the younger age groups (table 2). Also, almost exactly the same percentage of males complained of pain as did females.

TABLE 2. — *Incidence of Pain by Age and Sex of Patients Having Idiopathic Scoliosis, 1941.*

Age, Year	Both Sexes			Male			Female		
	Total	With Pain		Total	With Pain		Total	With Pain	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
10-19	14	5	35.7	4	2	50.0	10	3	30.0
20-29	25	14	56.0	8	2	25.0	17	12	70.6
30-39	38	28	73.7	16	11	68.8	22	17	77.3
40-49	55	39	70.9	26	20	76.9	29	19	65.5
Total	132	86	65.2	54	35	64.8	78	51	65.4

The pain was located in the back, the shoulder girdle, the scapular area, the region of the sacro-iliac joints, and the hips. Most of the pain was an ache located in the lower part of the back. The severity of the pain was classified as mild, moderate, or severe according to arbitrary criteria. Mild pain was defined as pain of a transitory nature or an aching for a period of less than twelve months' duration but greater than one month's duration; moderate pain as sharp pain of short duration, recurrent radiating pain, or aches of twelve months' or more duration; severe pain as including any incapacitating pain and all constant sharp pain or aches. Using these criteria it was found that, in 1941, 19 patients had mild pain, 63 patients had moderate pain, and 4 had severe pain. The preponderance of moderate and severe pain was found to occur after the age of 20 years, the major incidence of pain in patients under the age of 20 years being classed as mild.

Ten years later, in 1951, we were able to trace only 76 of these 132 patients. From the follow-up letters it is evident that the severity of the pain did not change appreciably in the intervening ten years in those patients who had pain in 1941. In a few cases the pain had improved; but, for the most part, patients reported that the pain was essentially the same as it was in 1941. It is perhaps quite significant that nearly 50 per cent of the 26 traceable patients who did not have pain in 1941 complained of either a mild or a moderate degree of pain by 1951.

The patient's age at the onset of pain was determined for the 98 patients who had pain by 1951 (table 3). The onset of pain was greatest in the group aged 30 to 39 years, and this age group accounted for 36 per cent of all patients in whom pain developed. This is the same percentage as in James' series of cases.[5] He stated that in 12 (36 per cent) of 33 cases in which there was pain the pain developed between the ages of 30 and 39 years.

TABLE 3. — *Age at Onset of Pain.*

Age, Year	Both Sexes	Male	Female
10-19	13	6	7
20-29	24	4	20
30-39	35	19	16
40-49	26	12	14
Total	98	41	57

TABLE 4. — *Degree of Pain Related to Degree of Scoliosis.*

Degree of Pain	Degree of Scoliosis*		
	Mild	Moderate	Severe
None	32	8	6
Mild	19	0	0
Moderate	57	4	2
Severe	0	1	3
Total	108	13	11

* Mild scoliosis was a major curve of less than 15 degrees; moderate scoliosis, 15 degrees to 30 degrees; severe scoliosis, more than 30 degrees.

From table 4 it can be seen that there is little or no correlation between the severity of the scoliosis and the severity or even the incidence of associated pain. The incidence of pain, however, is appreciably higher in cases of lumbar and thoracolumbar curves than it is in cases of cervicothoracic, thoracic, or combined thoracic and lumbar curves.

Summary

One hundred thirty-two cases of idiopathic scoliosis were studied from the standpoints of (1) incidence of pain, (2) age of patient at onset of pain, and (3) severity of pain.

When they were examined in 1941, 65.2 per cent of these patients were found to have pain of some degree.

Approximately 50 per cent of the 26 traceable patients who did not have pain in 1941 complained of some degree of pain in 1951.

More patients (36 per cent) noted the onset of pain between 30 and 39 years of age than during any other decade of life.

There appeared to be no good correlation between the degree of the scoliosis and the severity of the associated pain.

THE NATURE AND TREATMENT OF FIBROSITIS *

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Some two or three years ago, I was asked to take part in a joint investigation into a treatment of fibrositis, for which extensive claims were made; when these were first shown to me, I was very skeptical. However, we all felt that even a negative result would not be wasted, and as the investigation proceeded, we became more and more impressed with the results that were obtained.

The original technique was worked out by Dr. G. Laughton Scott, who claimed that, over a period of years, by using local injections consisting of 5 parts Benzyl Salicylate, 5 parts Camphor, and Arachis Oil to 100, he had found that not less than 60 per cent of cases could be classified as symptom free, or much improved, that disability time was shortened, that the results were better, and more persistent than those of other methods in use at present, and that beneficial results depended on close adherence to the technique.

Method

His method consisted essentially in laying down a carpet of the injected material close to the origin of the affected muscle. Fig. (1) shows on the skeleton the site of injection for pain at the lumbo-sacral junction. Figs. (2) and (3) show the sites for pain in the lower lumbar and gluteal areas.

Fig. 1. — Injection: Sacro-iliac sulcus.

Fig. 2. — Injection: Bodies of L3 and L4 vertebrae.

The immediate and follow-up results greatly exceed my expectations, being briefly as follows: four workers averaging fifty cases each secured the final figures of 78.5 per cent symptom free or much improved, 18 per cent

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slightly improved or unchanged, and 3.5 per cent become worse.

All these cases were followed for a minimum of six months, and the following standard approach was used by all the investigators to ensure uniformity.

Each was responsible for the selection of cases, differential diagnosis and recording the results obtained. Each case was assessed at the completion of the course of treatment, and again at the end of six months. To ensure that Dr. Laughton Scott's exact technique was followed, it was arranged that he should carry out the great majority of treatments himself. The method of assessment used was to classify cases into five categories: Symptom free (A), Much improved (B), Slightly improved (C), No change (D), and Worse (E). For simplicity of presentation of results, A & B, and C & D were amalgamated.

Agreement was reached between all the investigators as to the areas to be treated, and the symptoms and physical signs to be accepted. These were as follows — symptoms, pain consistent in type and localization, associated with stiffness of movement, and often with definite periods of remission. Physical signs consisted of tenderness accurately localized, corresponding closely and anatomically accurately with the symptoms. Areas of palpable muscle spasm corresponding to these gave further confidence that the patient was not a psychosomatic case.

Fig. 3. — Injection: Sacro-sciatic notch.

Fig. 4. — Injection: Supra-scapular notch.

In all the cases great care was taken to exclude conditions such as prolapsed intervertebral disc and Copeman's fibro-fatty tumor, when these might cause a closely similar syndrome. Despite these precautions, however, errors in diagnosis occurred, necessitating the rejection of some 14 per cent of cases after treatment had commenced.

The treatment used consisted of the injection of 5 ml. of benzyl salicylate mixture at weekly intervals, unless the commonly resulting malaise lasted more than 24 hours. In such cases, the next injection was deferred a week, or the amount reduced. In this respect it should be noted that all observers agreed that the appearance of this general malaise was a favorable sign, and was usually followed by a good result.

Each of the four series was carried out at a different hospital and in widely separated areas, Dr. Cowan's being at Sunderland, Mr. Plewes' at the Luton and Dunstable Hospital, Dr. Heald's at the Arthur Stanley Institute, London, and mine at the Royal Free Hospital, London. By this wide dispersal of clinics and with each observer having complete independence to express his own opinion, it was hoped to advance our knowledge, and give a thorough trial to the treatment outlined in the earlier part of this paper.

Controls

In addition to the main series, the following controls were carried out:

(1) Mr. Plewes, at the Luton and Dunstable Hospital, treated twenty cases with Arachis Oil only, in exactly the same way as the benzyl salicylate mixture (B. S. Co.) series, alternate patients being taken and injected by Dr. Laughton Scott, the solution being exactly similar in appearance to the B. S. Co., and the selection being made by Mr. Plewes. The results obtained were 2 (or 10 per cent) symptom free or much improved, 16 (or 80 per cent) slightly improved or unchanged, and 2 (or 10 per cent) were worse.

(2) Dr. Cowan, in Sunderland, treated twelve cases with multiple needling to ascertain whether autohaemotherapy, or some such process, might be responsible rather than the drugs in the actual material injected. Of these twelve controls, two did not return after the first operation, two showed slight improvement after three, one was completely relieved of symptoms, two became worse, and five showed no change after five operations.

Fig. 5. — Injection: Neck of the scapula.

(3) My Registrar, Dr. Dobney, injected fourteen normal volunteers with the B. S. Co. solution in order to ascertain if any malaise of the type so constantly found by all the investigators was produced. In no case was this characteristic malaise produced.

(4) I personally treated thirty-four cases of a similar type with histamine ionization and deep massage; these gave the following results — 44.1 per cent symptom free or much improved, 50 per cent slightly improved or unchanged, and 5.9 per cent did not complete the treatment owing to severe general reaction. The average number of treatments in this control series

was 12.4 per patient, given three times a week, compared with 8.3 for my B. S. Co. series, given once a week. It was also noticeable that the successes in the controls were largely among the cases with a short history, whereas the B. S. Co. patients were evenly spaced in this respect.

Comment

All the collaborators were unanimous on the following points:

(a) That the time taken over treatment was reduced with the B. S. Co. as compared with other forms of treatment, thus greatly lowering the time lost from work.

(b) That the treatment produced greater improvement, and ultimate relief of symptoms than other methods familiar to them, and that this improvement was maintained for more than six months (average 8.9 months).

(c) That there was a noticeable improvement in the general health of the patient in a large number of cases.

(d) That there was a close relation between successful results and injections that were given close to the bony attachments of the muscles. This is a point I would like to emphasize, as I have employed the technique described to a considerable extent myself since the completion of the investigation, and have found that my results have improved steadily as I became more experienced in its use. I think it is of interest to record that I deliberately injected some six cases in the muscle belly, and in no case did I obtain any improvement until I commenced to inject down to the bony attachments. I would therefore add as a warning to anyone embarking on this treatment, that he should follow the technique closely, and be prepared to undertake a considerable period of trial and error before passing a final judgment.

Further Investigations

So interested and impressed was I with the results obtained that I determined to make a small concentrated study of painful shoulders whose symptomatology was pain developing in the shoulder for no known reason, radiating down the upper arm, the pain being severe even at rest and increasing on movement, with marked tenderness on pressure over the neck of the scapula and/or the supra scapular notch. I have always found that this type of lesion is particularly difficult to treat with success either by physical measures or by injections of local anesthetic, almost always needing a very prolonged course of treatment, and often ending with a frozen shoulder. I thought it would be most interesting to see if this condition would respond to the technique we had used almost exclusively for low back pain. I am happy to tell you that here also I have had considerable success.

The method of injection used followed the general principles employed in the previous series, namely, down to the bony origin of the muscles in the tender areas. Figs. (4) and (5) show on the skeleton the sites of injection for supra-scapular notch area and neck of scapula, respectively. Each injection was preceded by 1-2 cc. of 1 per cent procaine hydrochloride (Novocain) to alleviate immediate pain, and was followed by 3-4 cc. of B. S. Co. if no improvement was found in six injections, treatment was abandoned, and the case considered a failure.

Comment

Injections were given at weekly intervals, without any other treatment, the results being evaluated under the same headings as for the investigation on fibrositis. These give the following results in 12 cases — 9 or 75 per cent

symptom free or much improved, 3 or 25 per cent no change. The average number of treatments was 2.6. As a comparison, a series of 12 cases treated by physiotherapy needed a minimum of eleven, and a maximum of sixty treatments to produce a similar result. I regret the number of cases is small, but the condition is by no means as common as fibrositis.

I would like to make it clear that I have been dealing with the pain factor in this series. The question of restriction of movement in the affected shoulder is quite a different problem, being in the great majority of cases the result of failure to move the joint. I do not claim that this treatment will clear it up, but if it is commenced early enough it will prevent the formation of a "frozen" shoulder. Once this has occurred only prolonged physiotherapy, possibly combined with manipulation of the joint under an anaesthetic, will regain the lost movement.

This injection, however, is one that may produce severe pain for 24-48 hours afterwards. I believe this is due to stretching of muscle tissue, which in these areas has little space to expand, the prolonged pain being due to the slow absorption of the oily solution. I have encountered the same pain, but for a much shorter time, after injecting local anaesthetic to the same areas. It is also important to be certain the B. S. Co. is not injected into a blood vessel, or an oily embolus may be produced.

With regard to the pathology of this condition, it is interesting to note that biopsies taken from the muscle attachments deep to the tender areas showed aggregations of small cell infiltration, similar in type to those described in various rheumatic conditions, and the periosteum beneath was found to be markedly thickened. I will not, however, enlarge on this as further investigations are being undertaken in respect of these findings.

Sincere thanks are due to Dr. C. B. Heald, the director of our research, and to my colleagues, Mr. L. W. Plewes, and Dr. I. Cowan for permission to publish their results; also of the Dora Garrad-Anderson and the Halley-Stewart Trusts for their generosity in making our research possible.

Discussion

Dr. Fred B. Moor (Los Angeles): I wish to thank our British colleague for describing to us a new approach to the problem of the treatment of fibrositis, which, we must admit, is in an unsatisfactory state. This situation will continue until more is known about the pathological physiology of the condition. Until that time, our treatment is bound to be mainly empirical.

The controversy concerning the existence, the etiology, and the pathology of fibrositis was nicely stated by Cyriax[1] when he observed that its existence is affirmed by most clinicians and denied by most pathologists. Cyriax maintained that primary fibrositis was an imaginary disease and that the symptoms ascribed to it were the result of articular disorders, mainly of the spine. Fibrositis secondary to trauma and infections, however, he considered, a clinical entity. Attention has also been called by Copeman and Ackerman[2] to the relationship of the "basic fat pattern" to the distribution of gluteal and lumbar pain in cases where pain was ascribed to fibrositis. They found by actual dissections that increase in volume of fat lobules inclosed in unyielding fibrous capsules gave rise to pain. Actual herniations of fat through weak spots in the capsules were observed to occur. Surgical procedures gave relief. Nevertheless, in spite of the unsatisfactory state of our knowledge concerning the etiology of fibrositis, those of us who have to deal with the condition in patients from day to day are forced to treat it, if on a more or less empirical basis.

We are indeed indebted to Dr. Martin for this controlled clinical study on a new method of treatment of fibrositis. From a pharmacological standpoint, it is difficult to explain mode of action concerned in the local injection of his benzyl salicylate compound. The results reported are impressive: 48.3 per cent free from symptoms and 32.2 per cent much improved, a total of 78.5 per cent. I do not have immediately available any reliable figures on the results of our usual treatment of fibrositis in this country by heat, massage and exercise. It is my impression, however, that our results will approach those of Dr. Martin, although we must admit that our procedures are much more laborious and often more prolonged.

1. Cyriax, J.: Fibrositis, Brit. Med. J. 2:251 (July) 1948.
2. Copeman, W. S. C., and Ackerman, W. L.: Edema or Herniations of Fat Lobules as a Cause of Lumbar and Gluteal "Fibrositis," Arch. Int. Med. 79:22 (Jan.) 1947.

BACKGROUND FOR AN UNDERSTANDING OF SPINE AND TRUNK FUNCTION *

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To gain comprehensive working knowledge of the functional anatomy of the vertebral column and the trunk, a brief survey of their phylogeny, aided by a review of some of the salient features in their embryology, appears essential.

Through structural adaptations, a term replete with implications, the trunk and spine of man have reached a level of organization which makes it possible for the human body to carry on under a great variety of stresses and strains in the course of an individual life span. We have gone far along this road of adjustment of the body to its environment but we are as yet not completely adapted to the upright position. This position has entailed widespread rebuilding and modification of the spinal and trunk architecture. Many of the ills that afflict the human column result either from a lack of complete adaptation to the upright position or from neglect and abuse we visit upon trunk and column by our insistence upon the conversion of our bodies into sedentary, sessile caskets in which to house our nervous systems and our digestive tracts, forgetful of the fact that nervous system and tracts to function at high levels require action as much as do trunk and spine.

The Vertebral Column

Man belongs to that vast animal assemblage in which the column forms the central longitudinal axis of the body. Preceding acquisition of a vertebral column, certain animals, probably precursors of the vertebrates developed a notochord (fig. 1), an elongate axial rod whose cells through turgor gave support, offered muscular attachment and appendicular connections for body organs and appendages. Man's own individual history repeats very briefly this notochordal phase of the past.

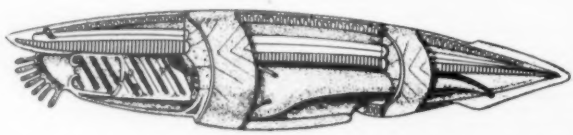

Fig. 1. —Schematic drawing of Amphioxus. The striated band extending from rostrum into the tail represents the notochord. Note the relation of the body musculature, represented in the two intact sections, to the notochord.

In early aquatic forms the notochord was replaced either by a cartilaginous or by an osseous backbone of individual vertebral elements in contrast to the single uninterrupted notochordal rod. Presumably this offered greater flexibility and strength than did the notochord. It must be remembered that the backbone with its associated musculature is the chief locomotor organ in the fish as well as in many amphibians and reptiles, and the short seg-

* This article is based on two lectures given before the American Congress of Physical Medicine, Denver, Colorado, September 1, 1951.

† Cleveland Clinic Foundation and Western Reserve University.

mental muscles prominent in these forms can exert considerable pulls upon various segments of the column. This column did not yet possess the secondary articular facets which become a part of the backbone in the land animals; the necessary elasticity was offered at the intervertebral discs. Ribs had already become associated with the column at the fish level.

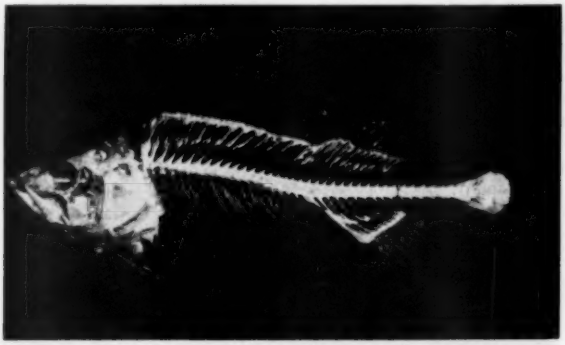

Fig. 2. — Skeleton of the bony fish. The spines extend from the centrally placed vertebral column. Locomotion is chiefly by action of muscles pulls on the column.

In the fish there is little of vertebral differentiation. When it does occur it is found first at the junction of the head and column; secondly at the sacro-caudal junction. With the changing patterns in the caudal region, modifi-

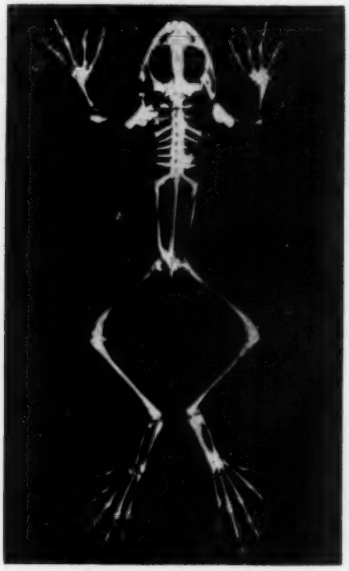

Fig. 3. — Skeleton of a frog. Emphasis is on the development of appendicular skeleton and muscles, while the column is greatly reduced and ribs are absent.

cations develop in the tail. Generally these are represented by reduction in size of the individual vertebral elements, loss of hemal arches, and always there is a failure of the neural canal to continue for any distance beyond the sacral level (fig. 2).

With the successful conquest of land by the Tetrapoda, or four footed land animals, great structural changes were demanded of the column. In the frogs for example (fig. 3) a high degree of specialization adapted the animals for jumping. In the turtles a heavy armour was imposed upon and fused with the column and the ribs, resulting in an unwieldly and inflexible covering into which head, tail and appendages might be withdrawn. The musculature associated with the spine became reduced in some of these early land forms and the appendicular skeleton and its musculature were magnified. Such mechanisms required considerable power for lifting and transporting the heavy bodies, a condition which brought in its wake larger hearts, a higher degree of vascularization and possibly changed food habits. A comparison of heart weight, amount of blood, and color of the muscle in the turtle with that of some other reptilians shows graphically the demands made by heavy

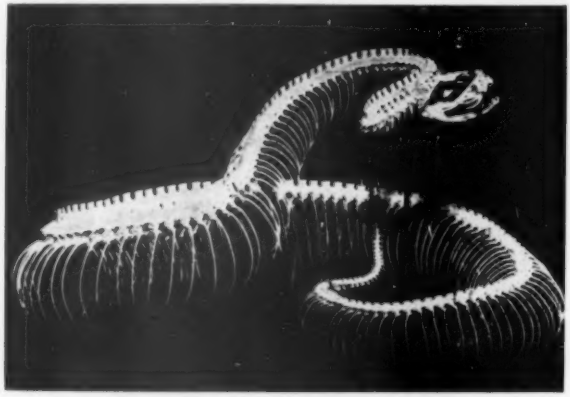

Fig. 4. — The skeleton of the snake. Loss of appendages has brought the ribs and vertebral column into prominence for locomotion. With the associated musculature the locomotor mechanism may be compared to an elongate spring in which the ribs form the hoops.

armour and skeleton. In the snakes, on the other hand, because of the loss of appendages, vertebral column and ribs are the dominant skeletal parts (fig. 4).

Nature ultimately devised a highly successful body form, already forecast in some of the reptiles. This type of body architecture reached its highest development in the mammals. Some anatomists explain these processes by the concept *EVOLUTION*. Others invoke the idea of *ARCHETYPES*. This latter concept implies that animal form or species, whatever its nature, strives to reach a pattern represented by an idea, or that present forms are related to basic or primitive models of the past. At best the animal can only approach this ideal. Still others dismiss the entire problem by invoking the concept of *DIRECT CREATION*. Whatever course life may have taken in the past it is impossible to ignore fundamental animal relationships and relegate them to mere resemblances. The basic features of the mammals which made their success and dominance possible are: an endoskeleton without armour, except

insofar as scutes, feathers or hair might be called an armour; articulated lever systems, which may become highly specialized hind and forelimbs, an elaborately articulated vertebral column strengthened at strategic points where head, fore and hindlimbs become associated with it; the entire body weight carried some distance from the ground and more or less equitably distributed over the two pairs of limbs (fig. 5).

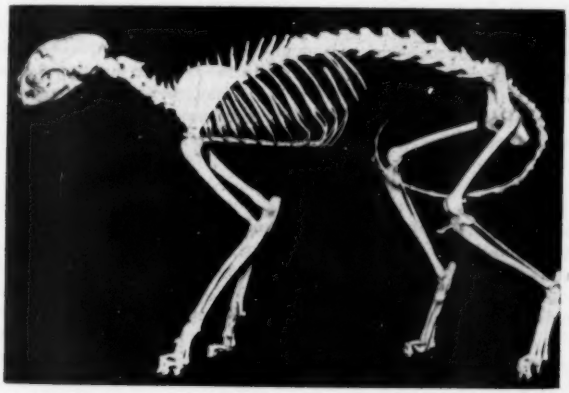

Fig. 5. —The skeleton of the cat. The column presents a long arch between the appendages and a shorter one from head to the middle thoracic region. It is articulated at the center and at the specialized articular facets.

The mammalian body became variously modified. In the birds, a group quite remote from mammals, and in one small group of primates, the Hominidae, by tilting the long axis (represented by the backbone) from a horizontal to a vertical plane an upright position was achieved. We do not know how

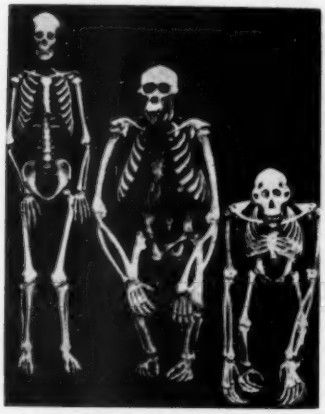

Fig. 6. — Skeleton of man, gorilla and orangutan. These three primate groups represent stages in development of the erect posture. Notice the tilted pelves in gorilla and orangutan, the relative length of arms and legs and the differences in the thoracic baskets when compared to man.

Fig. 7. —The gorilla, Bushman, former inhabitant of the Lincoln Park Zoo in Chicago. Note the chest supported and elevated by the arms. Compare the position of the extended head with the usual position of the human head. Courtesy R. Marlin Perkins, Director of the Lincoln Park Zoo, Chicago, Illinois.

long it required to develop this tilted type of primate skeleton to the point where it might be considered successful. All fossil evidence indicates that man did not appear upon the scene until somewhat less than a million years ago, although the early semi-erect primates go back some 60 million years ago to the Palaeocene.

Apparently man derived from a tree dwelling ancestry. His forelimbs or arms are no longer weight bearing organs, his free hands, forward vision, lack of olfactory development, his fingernails rather than claws, the retention of a clavicle, all point to such antecedents (fig. 6). While man, in comparison with the great gorilla, may not compete with the latter in strength he has gone far beyond in the matter of upright posture and intelligence (fig. 7). In the light of this history, let us examine the human spine and trunk, reviewing first very briefly their embryology before considering the adult anatomy.

Development

A. Skeleton. — What are the skeletal-muscular relationships in the embryo and the fetus? After the segmental somites of mesodermal origin are laid down in the embryo a rapid differentiation between epimere, mesomere and hypomere takes place. The hypomere becomes associated with the endodermal lining of the gut and with the body wall by a tangential split in its original single layer. The splanchnic layer surrounds the gut and forms its smooth musculature; the somatic layer forms the peritoneum and pleura. The space between the two layers is the coelom. The mesomere moves medially and becomes active in the formation of the kidney. The epimere segregates three types of cells: (1) the dermatome, responsible for the deep dermal layer of the skin; (2) the sclerotome, responsible for the development of the skeletal elements of the vertebral column and skeleton; and (3) the myotome from which will develop and differentiate the musculature of the back, abdomen and appendages (fig. 8).

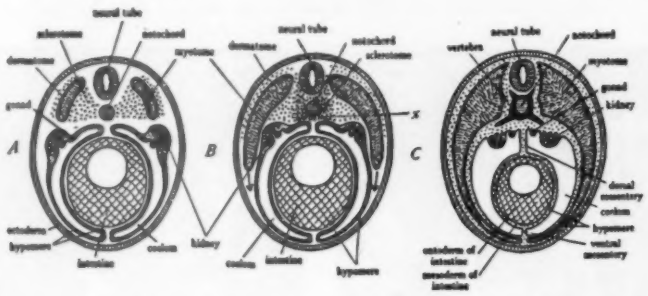

Fig. 8. — Three stages in the development of the vertebrate musculature and skeleton. The body muscles are derived largely from the myotomes, the vertebral column from the sclerotomes, and the deep layer of the skin from the dermatomes. Courtesy of The University of Chicago Press, Chicago, Illinois.

The blastemal vertebrae grow from three centers of chondrification, one for the neural process, one for the costal process and one for the vertebral body. Cartilages lengthen at the site and at the expense of the intervertebral discs and fuse briefly to form a continuous cartilaginous rod. With the constriction of the region between individual vertebral chondrifications the true interveterbral discs are differentiated: at their periphery appears the annulus fibrosis; the notochord loses its continuity; the cells of the original notochord

become clumped in the vicinity of the flattening discs and give origin to the nucleus pulposus. The notochordal cells lose also their cell membranes and form a syncytium similar to mesenchyme, with mucin formed about what remains of the former cells. The cartilages of the bodies of the vertebrae gradually ossify as the vascular tissue continues to invade the region. With these changes, transverse, neural, articular and laminar processes appear upon each vertebra plus a separate center for each rib.

With the establishment of these foundations the remainder of the story of the development of the column becomes one of differentiation of secondary supporting elements, namely, the ligamentous bands that hold the segments together.

B. Muscles. — Early embryologists were troubled with the question of neurogenic or myogenic initiation of muscle development. The brilliant early work of Harrison (1904) showed conclusively that removal of the frog spinal cord before histological muscle differentiation had begun did not prevent differentiation of muscle substance. Even individual muscles would differentiate from the myotomes in the absence of the nerves normally associated with them. It became obvious that muscle could develop independently of nerves. Nerves ordinarily serve as important keys to muscle origins and differentiation from certain specific myotome groups.

In the embryonic origin of muscles a characteristic of the myloblast antecedents consists of the small granules that give rise to muscle fibrillae. These fibrillae eventually fuse or become most intimately associated into columns. Subsequently they exhibit the beginnings of striation first indicated by differences of staining ability of the parts of the fibrillae. Longitudinal splitting of the fibrillae and their orderly arrangements into columns, causing similar light and/or dark striations to become arranged in the same planes, is virtually complete at the ten weeks stage in the human embryo.

It should be mentioned that a period of degeneration and reorganization occurs between the appearance of the fibrillae and the development of the definitive muscle fibers. During this phase new myoblasts arise only from existing ones, a process which appears complete in the 130-170 mm. human embryo. Following this the muscles increase in volume only by enlargement of individual fibers. The segmental division of the mesoderm has been observed as early as the 1.17 mm. stage and progresses in a cranial-caudal direction. Subsequently the segmentation continues and includes also a dorsoventral sequence.

With the differentiation of myotome, medial and lateral myotomic lamellae join loosely and migrate ventrally. They elongate into spindle shaped cells for the width of each myotome and eventually form the muscle cells. The deep back, trunk and neck muscles are formed by fusion and splitting of the myotomes. With disappearance of the myosepta they lose their segmental character. The deepest muscles on the other hand in direct contact with the vertebral column, i. e., multifidus, interspinous, intertransverse, levators costarum, retain some of their segmental characteristic.

With the downward growth of the thoracic myotomes the thoracoabdominal muscles become differentiated in the ventral myotomic extensions. The myotomes are interrupted by the ribs in the thoracic region and meet and fuse ventrally to the rib level. The ventral line of fusion of the left and right sheets marks the site of the future rectus abdominis muscle on each side of the mid-ventral line. Longitudinal splitting of the ventral muscle column differentiates these muscles from the ventro-lateral mass. The external and internal abdominal oblique muscles arise from tangential splitting further later-

ally in the myotomic sheet, and an additional separation of the internal sheet gives rise to the transverse abdominal muscle as the innermost layer. The internal and external intercostal muscles represent differentiations resulting from the tangential splitting that gives rise to the external and internal oblique muscles in the abdomen. Further dorsally, division of the sheet gives rise to the serratus posterior superior and inferior muscles. Subvertebral muscles arise from the development and subsequent fusion of myotomic elements associated with the ventral surfaces of the vertebral bodies.

The foregoing, in brief, deals with the skeletal and muscular elements with which we are here concerned. Their development may be summarized briefly:

(1) Skeletal and muscular elements arise from the epimere of mesodermal derivation.
(2) The sclerotomes arising from the epimere give rise to the skeletal elements which surround and replace the notochord except for the nucleus pulposus retained in the intervertebral discs.
(3) The myotomes give rise to the back muscles, and their ventral extensions are transformed into the intercostal and abdominal muscles.
(4) Subvertebral muscles arise from myotomic elements associated with ventral portions of the vertebral bodies.
(5) The original segmental pattern becomes largely obscured or lost except in the thoracic region and in the deep, short muscles of the back.

How may we summarize the functional aspects of the vertebral column in man?

We may consider it a flexible mast or upright beam, which on occasion takes on the aspect of an arch. This flexible beam is activated by a series of guy ropes, muscles and ligaments, under dynamic control. Variations in tensions produce changes in position of this mast or boom and of the associated body parts. Proprioceptive impulses, in the absence of definite conscious cerebral commands, maintain the balance of trunk and column by excitation of the proper motor centers.

Design and structure of the column implies that weight bearing is its central function both directly and through the extremities. Second it is associated with locomotion, a function derived from its lever-like composition. Third, it protects vital areas, always an integral part of its design.

The back is extended by the epaxial muscles acting jointly; it is flexed by the abdominal muscles, chiefly the rectus abdominis, and by gravity. It is swayed from side to side or rotated by the long and short back muscles acting unilaterally.

Articulations of Vertebral Column and Trunk

The articulations of the vertebral bodies are amphiarthroses, which means that they are only slightly movable. Extensive range of movement, however, may be achieved when all of the joints are involved. The vertebral body articulations are held in place by: (1) The anterior longitudinal ligament; (2) the posterior longitudinal ligament, and (3) the intervertebral fibrocartilages. In addition to amphiarthroses at the vertebral body articulations, there are true arthrodia or gliding joints between the articular processes of the vertebrae. These are enclosed by capsules and lined with synovial membranes. A third series of attachments holding the vertebrae in place are associated with the vertebral arches and include: Ligamenta flava, supraspinal ligaments, ligamentum nuchae, interspinal and transverse ligaments (fig. 9).

Group I. Anterior and Posterior Longitudinal Ligaments and Fibrocartilages.

The anterior longitudinal ligament is a strong, flat fiber band extending along the anterior border of the vertebral bodies. It is broader below and

thickest in the thoracic regions, with a further thickening at the concavities of the bodies of the vertebrae.

The posterior longitudinal ligament lies within the vertebral canal and parallel with the anterior ligament but along the posterior borders of the vertebral bodies. It is narrower below than above, and like the anterior it is

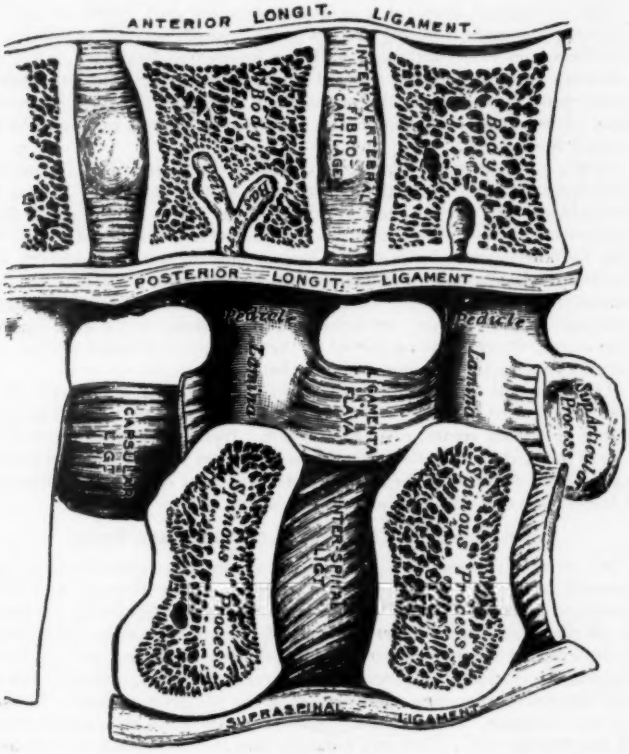

Fig. 9. — The ligaments associated with the human vertebral column. Courtesy of Lea and Febiger, Philadelphia, Pennsylvania.

thickest in the thoracic region. Opposite the intervertebral discs it spreads out to form dentate extensions about the intervertebral foramina.

The intervertebral fibrocartilages conform in shape to the vertebral bodies. In the cervical and lumbar region they are thicker in front than behind. They constitute about one-fourth of the length of the vertebral column in these regions.

The fibrocartilages are attached to the bodies of the vertebrae by thin layers of hyaline cartilage and to the anterior and posterior longitudinal ligaments. In the thoracic regions they are joined to the heads of the ribs at the demifacets by interarticular ligaments.

Group II. Ligaments of the Vertebral Arches.

These ligaments as well as those of the articular capsules are discrete bands uniting each vertebrae with its nearest neighbor above and below.

The ligamenta flava join the lamina of adjacent vertebrae. They are composed of yellow elastic tissue, and their elasticity preserves the upright position, aiding the spine returning to this posture after flexion.

The supraspinal ligament, a strong continuous cord, binds the apices of the spinous processes from the sacrum to the seventh cervical vertebra. Between the spines it is continuous with the interspinal ligaments, while from the seventh cervical vertebra upward to the external occipital protuberance and the median nuchal line the supraspinal continues as the ligamentum nuchae. It is of lesser development in man than in animals in which the head is carried horizontally.

Small, intertransverse ligaments complete the series of attachments, in this instance between the transverse process of the vertebrae. These ligaments play varying roles in the movements of the back. Thus in back flexion the anterior longitudinal ligament relaxes, and pressure is placed on the front of the fibrocartilages; the posterior longitudinal ligament, ligamenta flava, interspinal and supraspinal ligaments and the posterior portion of the intervertebral discs are stretched. Inferior articular facets move upward against the surfaces of the superior. In extension, the tensions on the back ligaments are reversed. Movements permitted in the column are forward flexion, backward extension, lateral flexion and rotation.

The degree of movement is greater in the neck than elsewhere. In the thorax it is limited because of the lower ratio of discs size to vertical bodies, presence of sloping spines, ribs and sternum. In the lumbar region while the discs are thick, the vertically set articular processes restrict rotation although so-called pure rotation of the lumbar vertebrae does occur. Anteroposterior and lateral movements are relatively free in the region.

Blood Supply and Innervation of Column and Trunk

A. Arterial Circulation. — The arterial supply to the column and the trunk is derived from the segmental aortic branches in the thoracic and lumbar regions and from spinal branches of the vertebral arteries in the cervical region. In the thorax, anastomoses between the segmental (intercostal) arteries and the internal mammary arteries and between the latter and the inferior epigastric artery supply the trunk. In the cervical region, muscular branches of the vertebral artery form anastomoses in the posterior surfaces of the bodies of the vertebrae. In the lumbar region, the segmental arteries are in series with the intercostals. They run laterally into the abdominal wall and form anastomoses with the lower intercostal, subcostal, iliolumbar, deep circumflex and inferior epigastric arteries. Their posterior rami supply the muscles and the skin of the back. Spinal branches enter the vertebral canal and, like the spinal branches of the intercostals, distribute themselves to the spinal cord and its membranes. The musculature of this region is supplied by small muscular branches from the lumbar arteries as well as from their posterior rami.

B. Venous Circulation. — The return circulation from the trunk and the spine is accomplished largely by venae comites, with exception of those draining the immediately surrounding muscles. Two intricate plexuses, an external, superficial to the vertebral bodies and spines, and an internal, lining the vertebral canal, extend along the spine with continuous anastomoses between the two. The external is best developed in the cervical region, where its posterior

division makes further anastomoses with vertebra, occipital and deep cervical veins.

The internal vertebral plexuses arrange themselves roughly into two anterior and two posterior longitudinal veins. They communicate through venous rings (retia venosa vertebrarum) as well as with the vertebral veins, occipital sinus, basilar plexus, and the condyloid emissary vein in the skull. Intervertebral veins accompany the spinal nerves through intervertebral foramina and drain blood from the cord and the internal and external plexuses and into the vertebral, intercostal, lumbar and lateral sacral veins. The orifices of these intervertebral veins are supplied with valves.

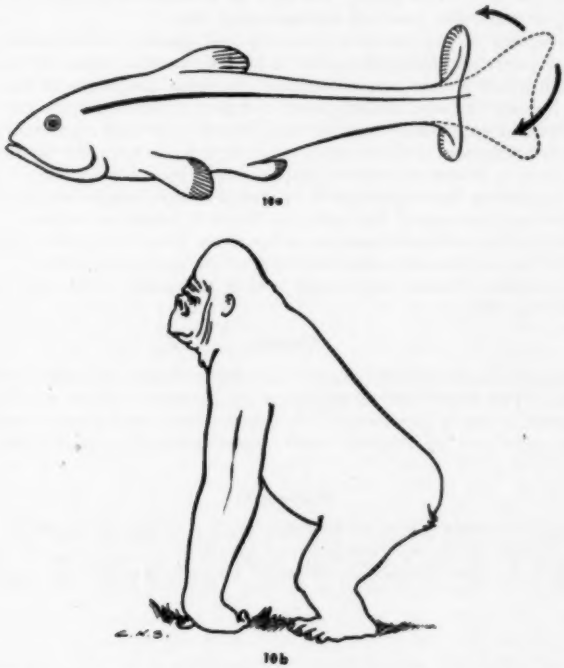

Fig. 19. — (a) Schematic drawing of a fish emphasizes the significance of the spinal column in locomotion. (b) The ape shows the tilted pelvis, reduced lumbar curve, erect head, and the role of the arms and of gravity in elevating the thorax.

These are the skeletal, muscular, supporting elements, and vascular channels that constitute the trunk and the column. It must not be assumed, however, that these parts considered as static elements include all that constitutes the living trunk and column. The living human system is a dynamic system built for action. It represents the response of man and his antecedents to the environment and its vagaries; a response reflected in untold minor and a large number of major structural adaptations.

We call the adaptations functional; they permit a high degree of freedom, a wide range of activity, the end result of which is an increased assurance for

the continued maintenance and existence of the body. With advancing age and neglect the activities become increasingly restricted to such an extent that sooner or later some vital part of the mechanism breaks down and the dynamic nature of the organism is superseded by the dead structure, which after a brief period of decay is further reduced to a more probable state in which the building stones are separated into stable compounds and even into elements. Given the opportunity they again find their place in a living body, which may, however, be far below the human in level of organization. Repeated cycles of birth, growth and decay of living stuff may through the machinations of chance elevate such elements to human levels.

This description has not concerned itself with a detailed account of the muscle action of spine or trunk. For such an account the anatomy texts offer a wealth of detail that need not be duplicated here.

The survey of the changing functions and modified relationships in the preceding pages are designed to offer a broader outlook upon the two body parts with which we are here concerned. To those working with the human body it becomes a never ceasing source of deep interest. Knowledge of its background, of its similarity to other body types confronted with similar problems of body support and function, must shed light upon the factors of its maintenance in health and its restoration after disease or injury.

In conclusion the suggestion is offered that man might well imitate the fish in the maintenance of the spine; for the fish, whose locomotor system is the spine and its associated muscles, keeps these parts constantly active (fig. 10a). For the trunk, man might well look to the ape which maintains a tilted pelvis, a reduced lumbar curve, and a well balanced thorax and adducted scapulae (fig. 10b).

Abstract

Comparisons are offered between the spine and trunk of lower vertebrates and man. The embryonic development of vertebral column and the back musculature is briefly summarized. A description of the ligaments associated with the spine and the vascular supply associated with it is included in the account.

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ARCHIVES of PHYSICAL MEDICINE
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.·. EDITORIAL .·.

ANCILLARY PERSONNEL IN THE FIELD OF PHYSICAL MEDICINE AND REHABILITATION

During World War II it early became apparent that the number and capacity of the schools of physical therapy could not be increased sufficiently to supply the number of trained physical therapists necessary to rehabilitate adequately the wounded and ill resulting from war. The number needed for this purpose was in addition to the number necessary for care of the civilian population. Also, following the war, great impetus was given to rehabilitation and reconditioning of Air Force personnel by the air corps and of civilian personnel on the recommendations of the Baruch Committee.

The development of new concepts of rehabilitation and the lack of knowledge of the standardized training of the physical therapist and the occupational therapist logically led to the use of people trained in physical education and to a lesser degree people trained in manual arts as substitutes for the approved groups of therapists. These people working with young patients in the army assisted in promoting the newer concept of reconditioning and rehabilitation and often achieved results rather rapidly. These workers were intelligent young men with good education and great enthusiasm. What was accomplished in a broad sense was new, although some of the concepts of rehabilitation were not new. The same basic principles developed by a few physiatrists were put into action but until the war the efforts of these physiatrists had been like a "voice crying in the wilderness."

Following the war there was a clamor by the graduates in physical education working in the army to be accepted in civilian hospitals. A few physical educators worked diligently to establish schools for training in this unnamed technical specialty. These people had had prerequisite training for physical therapy and did a good job under the circumstances through knowledge gained over several years of experience. The fact that good work was done resulted in the forgetting of many basic factors that are essential to standardized training of such therapists in peacetime. These physical educators worked later with psychiatric patients, using the skills for which they were trained. This circumstance likewise led to the belief that they were sufficiently trained in basic medical sciences to be qualified as ancillary aides.

About 1946, some 500 of the physical educators were accepted into the Veterans Administration. A job analysis was done and the United States Civil Service Commission set up requirements for what is known as an "exercise therapist." The exercise therapist was assigned the duties of giving practically all therapeutic exercise except passive and active assistive exercise which was delegated to the physical therapist.

When physical educators were first used, it was implied that they should give group exercise, recreation and reconditioning exercise for uninvolved parts. Treatment of disease entities was to be done by the physical therapist. However, in a short time this plan was changed both in the Army and in the Veterans Administration. The physical educator soon began doing practically

all routines of functional analysis, testing of muscle strength, re-education, hydrogymnastics and gait training. Even fitting of braces was being done by the so-called corrective therapist. Through the years the corrective therapist, the teachers of physical education and some physicians became very enthusiastic over the results obtained by this group in the armed services and Veterans Administration. There seemed to be the impression, partly erroneous, that the physical educators had some unusual qualification for doing physical rehabilitation that no other technical person had.

This enthusiasm, zealousness and aggression and the need for more trained persons influenced advisors of this group to bring pressure on proper authorities to provide official recognition of "corrective therapists" or "exercise therapists" as a new ancillary group in medicine.

The use of the physical educator in psychiatric hospitals also gave further impetus to the growth of other types of ancillary personnel in the field of medicine in addition to physical educators. Several groups sprang up as "adjunctive therapists" in the Veterans Administration. The teacher became an "educational therapist," librarians became "bibliotherapists" and manual arts teachers became "manual arts therapists." The musicians became "music therapists" and the vocational guidance people were considered as working on a therapist's level. The psychologist spoke of therapy, the social worker became "social case work therapist" and the beautician apparently began to think of himself or herself as a "cosmetotherapist."

There is not space to discuss all the groups, nor sufficient information available to be sure of what the educational backgrounds and duties of the various therapists are. The requirement for membership in the associations of the various fields of "therapy" other than corrective therapy seems to be a degree or experience in some allied field. The so-called therapy these various groups administer seems so vague that one cannot obtain a clear picture of the function of each group.

The physical educator and perhaps the manual arts teacher are sufficiently close in their preliminary training to comparable groups of standardized technical workers (physical therapists and occupational therapists) so that they can be compared more easily.

One cannot agree that the qualifications of the physical therapist and the "corrective therapist" are essentially the same, as stated in an editorial in the ARCHIVES in February, 1952. One of the prerequisites for training of physical therapists is that they be graduates in physical education, but thereafter they must take at least a year's training in an approved school of physical therapy in which they are given an intensive course in the basic sciences and techniques of physical therapy. These techniques include those of rehabilitation, certainly as far as therapeutic exercise is concerned. Physical therapists are trained in handling the sick and disabled under medical supervision.

The training of the physical educator is in relation to health education and the training of normal people. Until recently there was, in the courses in physical education, little basic science as applied to medicine and with a few exceptions little training in medically supervised clinical management of the handicapped and ill person. There is apparently little or no standardization of schools of physical education except by state commissioners of education. There are more than 300 schools of physical education, large and small, which graduate great numbers of students each year. It is apparent that many of these schools do not have clinical material and cannot obtain the extensive medical supervision required to train ancillary medical personnel.

The educational requirements of the manual arts therapist does not seem to be even as well defined as that of the corrective therapist; however, if academic degrees are required it can be seen that the use of their skills cannot help but overlap with those of the occupational therapist. They may have the prerequisite training of an occupational therapist, but they have not had basic and clinical training in the care of the sick except through experience.

If one analyzes what basic training should be given to these four groups it becomes quite obvious that, if they are to work in the field of physical rehabilitation, it should be much the same. To attempt to approve schools of physical education, and manual arts courses, as schools for additional ancillary aides would indeed be difficult. How can 300 schools of physical education be inspected? Why duplicate training when schools of physical therapy and occupational therapy are already in existence in medical centers where they must be established? To accept schools of physical education as suitable institutions for training therapists at present would greatly reduce educational standards. The obligation of the physician to see that his ancillary personnel are properly trained is one which is most important, because it is he who must maintain standards in order to fulfill his duty to the patient. He must look to the patient's welfare and protection. He must become aware of that which trained persons must know basically, and he must know what that person's educational background is and whether he will be equipped educationally to care for his patients competently and ethically.

It is a rather grave question as to whether new avenues of approval should be opened so that anyone who comes in contact with a patient during his convalescence should be qualified as a "therapist." Definite graded standards for all groups are being considered. These standards would make it imperative that all groups have courses varying from limited indoctrinational courses in the field of medicine to courses which provide definite, limited, formal, qualified training in order to be approved.

No doubt all groups now considered as "adjunctive therapists" in the Veterans Administration may find a place in medicine, but whether they all need to be certified as therapists is another question. Do they need to be called something different, and approved as such, if they are really just teachers, physical educators, musicians or psychologists?

The answer to the problem does not seem to be in a sudden attempt to register these groups immediately as therapists but lies in further careful study of the problem. The answer may be reached by development of graded positioning of various educational qualifications, indoctrination and formal courses of training according to the skill needed. There should not be approval of new groups which are so closely allied to existing approved groups that their work markedly overlaps that of the approved groups. It seems logical to conclude that there should be standardized basic training for those groups of workers who actually treat the ill and physically handicapped, with branching off for specialization in the various ancillary fields in physical rehabilitation, psychiatry and the like according to the demands believed needed by the physicians specializing in those fields. To continue to accept vague educational standards which were necessarily acceptable during the stresses of war may greatly reduce educational standards of peacetime. The obligation of the physician to see that his ancillary personnel are properly trained is one which is directly related to the welfare of the patient. It is the physician who must be aware of the basic knowledge of the aide, and it is the physician who is competent to determine whether that education is such as to equip his aide to care for patients under his medical supervision safely, competently and ethically.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Report American Registry of Physical Therapists

Period Jan. 1 to Dec. 31, 1951

Number of registrations completed.....481
Number examinations conducted.....579
Number retake examinations conducted..... 37

Certificates Issued According to School of Graduation

Name of School	Number of Graduates Registered
Albany Hospital, Albany, N. Y.	3
Boston University College of Physical Education for Women, Sargent College, Cambridge, Mass.	26
Bouve-Boston School of Physical Education, Boston, Mass.	14
University of California School of Medicine, San Francisco	16
Childrens Hospital, Los Angeles	10
Cleveland Clinic Hospital, Cleveland	6
College of Medical Evangelists, Los Angeles	13
Columbia University, College of Physicians and Surgeons, New York City	22
Duke University, Durham, N. C.	23
Hermann Hospital, Houston, Texas	8
State University of Iowa College of Medicine, Iowa City	17
University of Kansas Medical Center, Kansas City, Kans.	18
Mayo Clinic, Rochester, Minn.	29
University of Minnesota, Minneapolis	9
New York University, School of Education, New York City	24
Northwestern University Medical School, Chicago	14
Division of Physical Therapy of the School of Auxiliary Medical Services of the University of Pennsylvania, Philadelphia	1
St. Louis University, Division of Health and Hospital Services, St. Louis	18
Simmons College, Boston	12
University of Southern California, Los Angeles	20
Stanford University, Stanford University, Calif	35
University of Texas School of Medicine, Galveston	6
Washington University School of Medicine, St. Louis	11
D. T. Watson School of Physical Therapy, Leetsdale, Pa.	59
University of Wisconsin Medical School, Madison	26
Permanente School of Physical Therapy, Oakland, Calif.	21
Medical Department — U. S. Army —	
Fitzsimons Army Hospital, Denver	13
Walter Reed Army Hospital, Washington, D. C.	7
	481

Program to Help Disabled

A program of medical care, physical and social readjustment and job placement of the handicapped has been undertaken by Columbia University, Presbyterian Hospital, and the Institute for the Crippled and Disabled. Columbia has established a department of physical medicine and rehabilitation and Presbyterian Hospital has set up an independent physical medicine and rehabilitation service. The aims are to strengthen the rehabilitation and reeducation programs of the hospital and institute; to give the university divisions opportunities for the study and improvement of methods of rehabilitation; to provide a joint research and instructional program in rehabilitation; to effect a joint program providing all professional services in proper continuity and to provide for reciprocal interchange of facilities and services.

Newly Registered Therapists

May 9, 1952

Grigsby, John Booker, Apt. 8, Craig Ct., Franklin, Tenn.

Homyak, George, 201 W. Ridge St., Nesquehoning, Pa.

Hunt, Wilbur E., Rt. 2, Pineville, La.

Murray, Stanford E., 366 Hazelwood Terr., Rochester 9, N. Y.

Petitt, Floyd L., Box 472, Chautauqua, N. Y.

Sutcliffe, Esther B., 1530 E. 14th St., Tulsa 14, Okla.

May 15, 1952

Purnell, William Edward, 1130 Mt. Ephraim Ave., Camden, N. J.

May 19, 1952

Jeffery, Shirley Mae, 221 Erie St., Edinboro, Pa.

Tichenor, Mary C., 837 Tennessee St., Lawrence, Kan.

Newly Registered Therapists

June 6, 1952

Colligan, Jean Marie, 23 Northend Ave., Salem, Mass.

Cuetara, Nancy Ristine, 100 Memorial Dr., Cambridge, Mass.

Edmonds, Arreta Irene, 9 Third St., Pittsfield, Mass.

Fallon (Mary), Patricia, 34 Sackville St., Charleston 29, Mass.

Fitzpatrick, Elizabeth Ann, 286 Moreland St., Worcester 5, Mass.

Fuhr, Myra Ann, 216 Dartmouth Ave., Buffalo 15, N. Y.

Henderson, Jean Marie, 200 Edgeworth Rd., North Quincy 71, Mass.

Hunter, Marilyn Fitzgerald, 169 Islington Rd., Auburndale 66, Mass.

Kelly, Eleanor Mary, 96 Wentworth Ave., Lowell, Mass.

Mann, Sara Jane, 117 Youle St., Melrose, Mass.

Martin, Ruth Elizabeth, 285 Payson Rd., Belmont, Mass.

Philp, Jeanne Lois, 14 Royall St., Canton, Mass.

Singer, Janet Sylvia, 463 Delaware Ave., Albany, N. Y.

Singer, Norma Belle, 438 Manning Blvd., Albany, N. Y.

Accepted Devices

Sanborn Electrophrenic Respirator. — Manufactured by Sanborn Company, 39 Osborn St., Cambridge 39, Mass., device generates electric currents designed to stimulate the phrenic nerves, inducing contractions of the diaphragm in apneic patients. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list with the understanding that it should not be used for first aid by lay groups (such as fire departments), nor for prolonged care of apneic patients. It is a satisfactory means of resuscitation when used under direct supervision of a physician.

Ultrafaradic M-4 Impulse Generator. — Manufactured by The Ultrafaradic Corporation, 212 Cortland Ave., Winter Park, Fla., electrical device is designed to elicit muscular contractions by controlled shocks. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Blood Irradiation Society Meeting

At the June meeting of The American Blood Irradiation Society, Dr. O. L. Huddleston presented a paper entitled "Clinical Observations."

Samuel J. Harris

It is with regret we announce the death of Dr. Samuel J. Harris, Boston, Mass. Dr. Harris had been a Congress member for many, many years.

Personals

Dr. **Louis B. Newman,** Hines, Illinois, participated as a panel member in a symposium on "The Rehabilitation of the Cardiac Patient," at the meeting of the A. M. A., in Chicago, June 12.

Dr. **Howard A. Rusk,** New York, N. Y., addressed the annual meeting of the Health Division of the Welfare Council of Metropolitan Chicago on June 9.

Dr. **Donald A. Covalt,** New York, N. Y., was one of the discussors on the subject of "Chronic Disease" at the annual health conference of the New York State Department of Health, Lake Placid.

During the month of June, Walter Reed Army Hospital, Washington, D. C., conducted special teaching clinics, conferences and seminars, etc. Lt. Col. **John H. Kuitert** was in charge of the Neuromyology and Poliomyelitis Clinics.

Chicago Society Officers for 1953

At the May, 1952 meeting of the Chicago Society of Physical Medicine and Rehabilitation, the following officers were elected: Arthur A. Rodriquez, President; Milton G. Schmitt, Vice-President; I. F. Hummon, Financial Secretary-Treasurer. The Board of Trustees consists of Doctors Gusta Davidsohn, H. Worley Kendell, and Louis Gereb. The following committees were appointed:

Program Committee: Milton G. Schmitt, Chairman; F. A. Hellebrandt; C. O. Molander.

Membership Committee: Gusta Davidsohn, Chairman; Y. T. Oester; George Barnett.

Medical Economics: Joseph L. Koczur; Irvin Hummon; Y. T. Oester.

Publicity and Education: Joseph L. Koczur; Ray Piaskoski; Maxwell Flank.

New Jersey Society Meeting

The New Jersey Society of Physical Medicine and Rehabilitation met in Atlantic City on May 20 and elected the following officers: Thomas P. McConaghy, President; Bertram M. Bernstein, Treasurer, and Bror S. Troedsson, Secretary.

It was decided that the Society should try to bring physical medicine and rehabilitation treatments into the Medical-Surgical plan of New Jersey. A resolution was passed to the effect that the Society should cooperate with the technicians' society to get a law passed insuring licensing and more stringent educational requirements than are presently required by New Jersey statutes.

Postgraduate Seminar

Two hours will be devoted to physical medicine at the Postgraduate Seminar for the Academy of General Practice, Medical College of Alabama, on August 21, 1952.

Dr. James R. Garber has made this possible through his unselfish, generous and kind cooperation. Dr. Garber, incidentally, instituted the first session on physical medicine and rehabilitation.

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not represent the opinions of the American Congress of Physical Medicine.

THERAPY OF DERMATOLOGIC DISORDERS INCLUDING A GUIDE TO DIAGNOSIS AND A DERMATOLOGIC PHARMACOPEIA. By *Samuel M. Peck*, B.S., M.D., Dermatologist to Mount Sinai Hospital, New York City, and *George Klem*, M.D., Associate Visiting Dermatologist, Morrisania City Hospital, New York City. Cloth. Price, $6.50. Pp. 383, with 4 illustrations. Lea & Febiger, 600 S. Washington Sq., Philadelphia 6, 1951.

General physicians and students will find this compact volume a useful desk reference, especially so if an hour or two is devoted to a study of the material in Part I on pages 7 to 31. This section includes a topographical and differential diagnosis of 52 dermatoses in a cross reference diagrammatic and tabular form without confusing details. Part II describes general principles as well as specific therapy from the standpoint of management of internal diseases with skin manifestations, and the pure dermatoses and their treatment according to presenting symptoms. About 235 conditions are briefly described and grouped according to etiology, unknown etiology and clinical similarity. The section on contact dermatitis seems to have been written especially for the benefit of the industrial physician; whereas it should have been enlarged to include a list of external irritants and their most frequent sites of contact thus serving as a guide to any physician in the "detective work" so necessary in the recognition of the external irritant. Dermatopathology is omitted but has no place in a volume of this type. The resumé of standard internal and topical therapy, including the newer antibiotics, chemotherapeutic drugs and hormones, together with corticotropin and cortisone, is up to date. The authors frankly state that, in the main, the therapeutic agents which they themselves prefer are set forth in the paragraphs on treatment of the diseases. This accounts for the detailed methods for use of moccasin venom in the purpuras. Of interest to all physicians, especially the geriologists, are the sections on nevi and the tables of differential diagnosis between keratosis senilis, a common precancerous lesion, keratosis seborrheicum in which carcinoma rarely develops; also between basal cell and squamous cell carcinoma of the skin. The section on venereal diseases, syphilis, gonorrhea, granuloma inguinale, lymphogranuloma venereum and chancroid is concise and describes the important syndromes occurring within the particular disease. The treatment is brought up to date and the described use of bismuth preliminary to penicillin in certain of the syphilitic syndromes is based on sound principles. In the section on standard physicotherapeutic methods essential in the treatment of many dermatoses, cryotherapy, electrolysis, surgical diathermy, iontophoresis, medicated baths, ultraviolet irradiation and the Wood light are described and their uses indicated. Roentgen and radium therapy are omitted for obvious reasons. In Part III a well rounded list of drugs and prescription formulae is presented, together with a brief description, uses and dosage. These items are correlated with their mention in the section on clinical description of the dermatoses. A useful section is concerned with removal of medicinal stains. There is a good index.

FRACTURES AND DISLOCATIONS FOR PRACTITIONERS. By *Edwin O. Geckeler*, M.D., Fellow of the American College of Surgeons, Fellow of the American Academy of Orthopaedic Surgeons, Fellow of the American Association for the Surgery of Trauma, Diplomate of the American Board of Orthopaedic Surgery. Fourth edition. Cloth. Price, $5.00. Pp. 371, with 344 illustrations. The Williams & Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, 1951.

The number of editions of this book that have appeared within a little more than ten years testifies to its popularity. It has been reviewed previously in the ARCHIVES and needs no detailed introduction to most readers. It is a well written book on general orthopedic principles which stresses the more fundamental aspects of diagnosis and conservative treatment. It is written primarily for the general practitioner and the medical student and therefore its material is considerably condensed. In a few instances this reviewer felt that the surgical treatment of certain common fractures was discussed too briefly. For example, the only method of internal fixation of fractures of the neck of the femur discussed by the author was that with stainless steel screws. Surely, such methods as the blade plate, Smith-Peterson nail and perhaps intramedullary fixation are commonly enough encountered by the general practitioner to warrant some mention in a book such as this.

This book contains many gems of good advice that are well worth remembering. The author is logical in his approach to the mechanics of injury and surgical correction. This is a volume that is well worth inclusion in the library of those physicians who desire a convenient and readable reference concerning the most reliable methods of treatment of fractures and dislocations.

PHYSICAL MEDICINE ABSTRACTS

Present and Future Plans for the Rehabilitation of Patients in General Hospitals. Nila Kirkpatrick Covalt.

Mod. Hosp. 76:94 (Apr.) 1951.

Despite the published information, the growing interest in the field, and the actual establishment of rehabilitation programs, it is an all too common fallacy to consider that programs of physical medicine and rehabilitation are unnecessary in acute general hospitals and belong only in institutions which care for long-term illnesses and chronic disabilities. In the majority of instances, early treatment in an acute hospital can prevent a patient, even though he may be left with a chronic disability, from becoming helpless. This lessens the burden of the ever increasing number of individuals who must be cared for in chronic hospitals or convalescent homes. An amputee needs bed positioning within 24 hours after his operation, with stump exercises instituted as rapidly as possible — often within 48 hours. A unilateral amputee can be started on crutch training after only a few postoperative days. No amount of guided exercise the patient does daily will even then be adequate to prepare him completely for prosthesis walking. Once a prosthesis is procured, the physician then refers the patient to a physical therapist for walking training. This training takes one to three months, depending upon the site or sites of the amputation (above, below the knee, or bilateral), and upon the motivation of the patient. Training can be done with outpatient visits. It is accomplished more rapidly, and with a better walking pattern, if the amputee can remain at the training center and have concentrated treatment throughout a full day. Training in the use of an arm prosthesis usually is done by an occupational therapist. That training does not take as long. It is true that there is a shortage of physicians trained in physical medicine and in the other rehabilitation techniques. There is a shortage of qualified physical therapists, qualified occupational therapists, speech therapists, social workers and other ancillary personnel necessary to furnish a total rehabilitation program, even if the physical facilities are available. The object of this discussion is to show how rehabilitation programs can be started even when trained physicians and therapists are not available and even when adequate space, or money to build adequate space in hospitals, is not procurable. It is quite possible to start programs within any presently operating facility — although adequate space should be considered and included in building programs now contemplated, and in all future planning. Physicians and physical therapists will be available in time; adequate space should be allocated pending that time.

Effect of Physical Activity on Prognosis of Poliomyelitis. Robert M. Albrecht, and Frances B. Locke.

J. A. M. A. 146:769 (June 30) 1951.

Two hundred patients from the 1949 poliomyelitis epidemic in Nassau County, New York, are reported upon in this study. In each case a detailed history of the symptoms and of the physical activities from three days before the onset of illness to a number of days after the onset was taken. The term "paralysis," as used in this report, refers to other than bulbar paralysis, unless otherwise stated. The term "meningeal stage" describes the period of the illness characterized by one or more of the following, a positive Kernig sign, stiffness of the neck or back, and pain in the head, trunk, or thighs. Physical activities were classed in the histories as follows: bed rest; light activity, such as resting at home; normal activity, such as housework, office work, school or normal play; heavy activity, such as manual labor or strenuous sports or play. The physical activities of the patients were rated by one person who, in order to exclude bias, was deliberately kept uninformed of the extent of their paralysis at the time of rating. In rating the cases, both the type and duration of activity were considered. Since the evaluation of the extent of paralysis depends on the skill of the observer, and since the paralysis itself varies with time, an attempt was made to have all the patients muscle-graded by trained physical therapists approximately six months after the onset of illness. All of the gradings were tabulated on standard forms of muscle grading used routinely by the New York State Department of Health. There was found no correlation between the severity of paralysis and the activity in the three days preceding the onset of illness; nor did activity in the three days before the onset of the meningeal stage seem to influence subsequent paralysis. The bulbar cases were too few to permit conclusions to be drawn. There is no statistically significant relationship between severity of exercise and severity of paralysis, except in adults. Age is a major factor in the prognosis of poliomyelitis. Adults, irrespective of activity, are more severely affected than children. Factors other than age and activity, such as the nature of the virus, previous experience with it, the size of the infecting dose and constitutional factors, are of major importance in the prognosis of poliomyelitis.

PRELIMINARY PROGRAM

THIRTIETH ANNUAL SCIENTIFIC SESSION

AND

INSTRUCTION SEMINAR

American Congress of Physical Medicine

August 25-29, 1952

ROOSEVELT HOTEL NEW YORK, N. Y.

SCHEDULE OF INSTRUCTION SEMINAR

MONDAY, AUGUST 25

10:00 to 10:50—(A) **Physiologic Basis of Therapeutic Exercise.** HELLEBRANDT. Vanderbilt Room.

10:00 to 10:50—(1) **Vocational Counseling.** USDANE. Grand Ballroom.

11:00 to 11:50—(B) **Physiologic Basis of Therapeutic Exercise.** HELLEBRANDT. Vanderbilt Room.

11:00 to 11:50—(2) **Back Pain — Problems in Industry.** RUSSEK. Grand Ballroom.

3:00 to 3:50—(C) **Functional Anatomy of Spine.** MARKEE. Vanderbilt Room.

3:00 to 3:50—(3) **Treatment of Cerebral Palsy.** PERLSTEIN. Grand Ballroom.

4:00 to 4:50—(D) **Functional Anatomy of Forearm and Hand.** MARKEE. Vanderbilt Room.

4:00 to 4.50—(4) **Evaluation of Cerebral Palsy Child.** PERLSTEIN. Grand Ballroom.

TUESDAY, AUGUST 26

8:30 to 9:20—(E) **Present Status (Experimental) of Ultrasonics.** F. KRUSEN. Vanderbilt Room.

8:30 to 9:20—(5) **Modern Upper Extremity Prosthesis and Rehabilitation of Upper Extremity Amputees.** Lecturer to Be Announced. Grand Ballroom.

WEDNESDAY, AUGUST 27

8:30 to 9:20—(F) **Electromyographic Studies in Poliomyelitis.** KNOWLTON. Vanderbilt Room.

8:30 to 9:20—(6) **Practical Psychiatric Problems of Which the Physiatrist Should Beware.** SULLIVAN. Grand Ballroom.

THURSDAY, AUGUST 28

8:30 to 9:20—(G) **Research Methodology.** LION. Vanderbilt Room.

8:30 to 9:20—(7) **Supportive and Assistive Splinting of the Upper Extremity.** BENNETT. Grand Ballroom.

FRIDAY, AUGUST 29

8:30 to 9:20—(H) **Effects of Age on Physiologic Function and Its Implications in Rehabilitation.** THEWLIS. Vanderbilt Room.

8:30 to 9:20—(8) **Basic Mechanical and Muscular Elements in Pathologic Gaits.** BECHTOL. Grand Ballroom.

LECTURERS FOR INSTRUCTION SEMINAR

CHARLES O. BECHTOL, M.D. (by invitation), Clinical Professor of Orthopaedic Surgery, University of California, School of Medicine, San Francisco, Calif.;

ROBERT L. BENNETT, M.D., Director of Physical Medicine, Georgia Warm Springs Foundation, Warm Springs, Ga.; Professor of Physical Medicine, Emory University School of Medicine, Emory Univ., Ga.;

FRANCES A. HELLEBRANDT, M.D., Professor of Physical Medicine, Head of Department of Physical Medicine and Rehabilitation, University of Illinois College of Medicine, Chicago, Ill.;

G. CLINTON KNOWLTON, Ph.D. (by invitation), Physiology Dept., Emory University School of Medicine, Emory University, Ga.;

FRANK H. KRUSEN, M.D., Professor of Physical Medicine and Rehabilitation, Mayo Foundation, and Head of Section on Physical Medicine and Rehabilitation, Mayo Clinic, Rochester, Minn.;

KURT S. LION, Ph.D. (by invitation), Associate Professor of Applied Biophysics, Biology Dept., Massachusetts Institute of Technology, Cambridge, Mass.;

JOSEPH E. MARKEE, B.S., Ph.D. (by invitation), Professor and Chairman, Department of Anatomy, Duke University School of Medicine, Durham, N. C.;

M. A. PERLSTEIN, M.D. (by invitation), Pediatric Department, Northwestern University and Cook County Graduate School of Medicine, Chicago, Ill.;

ALLEN S. RUSSEK, M.D., Assistant Professor of Physical Medicine and Rehabilitation, New York University College of Medicine, New York, N. Y.;

JOSEPH D. SULLIVAN, M.D. (by invitation), Instructor of Psychiatry, Cornell University Medical College and Columbia University College of Physicians and Surgeons, New York, N. Y.;

MALFORD W. THEWLIS, M.D. (by invitation), Director, Thewlis Clinic; Consulting Physician, South County Hospital, Wakefield, R. I.

WILLIAM M. USDANE, B.A. (by invitation), Executive Director, Vocational Rehabilitation Dept., Chief of Special Placement, Institute for the Crippled and Disabled, New York, N. Y.

Date.....

APPLICATION FOR INSTRUCTION SEMINAR

In Conjunction with the 30th Annual Scientific and Clinical Session of the AMERICAN CONGRESS OF PHYSICAL MEDICINE

August 25-29, 1952

The Roosevelt Hotel, New York, N. Y.

Name.....
(Please print)

Address.....
(Please print)

Member A.M.A.....Member County Medical Society

.....
(Give Name)

If Government Service, state briefly.....

Note: Members in good standing of the American Registry of Physical Therapists or the American Occupational Therapy Association are also eligible to attend.

Make up schedule in space below, listing courses by hour, day and number and/or letter (watch, please do not duplicate):

.....
(Signature in Ink)

Please make check payable to and mail with application to

American Congress of Physical Medicine
30 North Michigan Avenue Chicago 2, Illinois

GENERAL INFORMATION

RULES GOVERNING THE READING OF PAPERS

No paper or address before the Congress shall occupy more than fifteen minutes in its delivery. The program is so arranged that all the time is utilized and it is therefore imperative that the stated time schedule be closely followed.

All papers read before the Congress shall become the property of the Congress for publication in the official journal. Each paper shall be deposited with the secretary of the section when read.

THE CONVENTION

The registration desk will be open at 10:00 a. m., Monday, August 25 for registration. It is important that everyone register before entering the lecture hall. Those not wearing the official badge will be refused admission. This meeting is not open to the public. No registration fee will be charged.

BUSINESS SESSIONS

The annual business meetings for the members of the Congress will be held on Monday, August 25, at 8 p. m., and on Tuesday, August 26, at 4:30 p. m.

CONGRESS DINNER

The annual Congress dinner will be held on Wednesday evening, August 27 at 7:00 p. m., dress is optional. Exhibitors and guests are welcome. An interesting but brief dinner program has been arranged. You will enjoy this session, the only social function of the convention.

THE INSTRUCTION SEMINAR

Courses are offered in two separate groups: One group, designated by letters, consists of eight lectures on basic subjects. A second group of eight lectures, designated by numerals, will present more general and clinical subjects. Physicians as well as physical therapists who are registered with the American Registry of Physical Therapists will be permitted to register for these courses. Members in good standing of the American Occupational Therapy Association are also eligible to enroll for the instruction course.

The schedule of the seminar, as arranged, will permit attendance at both the course and scientific sessions.

Each registrant for the course is allowed the choice of one lecture during a period. The charge for the complete schedule of eight lectures is $15.00. Fewer than eight lectures may be scheduled at $2.00 per lecture. The right is reserved to reject any application if the Course Committee finds it desirable to do so. Registration for specific courses cannot be guaranteed when quotas are filled.

Those who have not completed their registration for the course should do so before attending any of the lectures. No one will be admitted to any of the course lectures without the official registration card for the course. Registration for the course may be completed on Monday, August 25, starting at 8:00 a. m., and continuing throughout the week starting at 8:00 a. m. at the main registration desk.

AMERICAN SOCIETY OF PHYSICAL MEDICINE AND REHABILITATION

The American Society of Physical Medicine and Rehabilitation will hold its annual meeting and dinner, 7:00 p. m., Thursday, August 28.

EDUCATIONAL CONFERENCE

The Educational Conference is open to members of the Congress and others by invitation. The Conference will convene at 2:00 p. m., Monday, August 25. An interesting program has been planned.

SCIENTIFIC EXHIBITS

Scientific exhibits will be on display again and should prove of great interest. As was the custom formerly, medals will be awarded to those exhibits which are adjudged the outstanding one by the committee on scientific awards and will be announced at the annual Congress dinner.

TECHNICAL EXHIBITS

The program of the scientific sessions and instruction seminar has been arranged with intermission periods to give time for visits and inspection of the technical exhibits. As these exhibits have been arranged with considerable effort, we urge every member and guest to set aside sufficient time for a complete tour of all exhibits.

Exhibits will be open from 9:00 a. m., to 5:00 p. m., Tuesday, August 26 through Thursday, August 28, and Friday, August 29 till 12:00 noon.

EDITORIAL BOARD

The annual meeting of the Editorial Board will be held Tuesday, August 26, 6:30 p. m., at dinner.

AMERICAN REGISTRY OF PHYSICAL THERAPISTS

The annual meeting of the Boards of the Registry will be held Wednesday, August 27, 12:30 p. m. at luncheon.

HYDROTHERAPY GROUP

There will be a subscription luncheon meeting for the group interested in hydrotherapy on Tuesday, August 26 at 12:15 p. m.

VETERANS ADMINISTRATION

Official Meeting of Veterans Administration Chief Consultant, and Area Consultants, Physical Medicine and Rehabilitation; Co-Chairmen, Donald A. Covalt, M.D., A. B. C. Knudson, M.D., Monday, August 25, 9:00 a. m. to 12:00 noon.

Annual VA luncheon for Chiefs, Consultants and Attending Physiatrists, Physical Medicine and Rehabilitation, Thursday, August 28, 12:15 p. m.

SCIENTIFIC FILMS

Several scientific films will be shown during time of convention.

COMMITTEE ON ARRANGEMENTS NEW YORK SOCIETY OF PHYSICAL MEDICINE

Hans J. Behrend, M.D., Chairman.
Arthur S. Abramson, M.D.
Donald A. Covalt, M.D.
Cassius L. de Victoria, M.D.
Otto Eisert, M.D.
Morton Hoberman, M.D.
Madge C. L. McGuinness, M.D.

SCHEDULE OF DAILY ACTIVITIES

30TH ANNUAL SESSION

MONDAY, August 25

8:00 A.M. Registration, Mezzanine.
9:00 A.M. Meeting, Veterans Administration Consultants (See bulletin board for room number).
10:00 A.M. Board of Governors, Congress, Vanderbilt Room, #6.
10:00 A.M. Instruction Seminar, Vanderbilt Room, #3-4-5.
10:00 A.M. Instruction Seminar, Grand Ballroom.
11:00 A.M. Instruction Seminar, Vanderbilt Room, #3-4-5.
11:00 A.M. Instruction Seminar, Grand Ballroom.
12:00 Noon. Luncheon.
12:15 P.M. Luncheon, Advisory Committee on Education, Council on Physical Medicine and Rehabilitation, American Medical Association (by invitation), (See bulletin board for room number).
1:00 P.M. Scientific Films, Small Ballroom.
2:00 P.M. Educational Conference, Small Ballroom.
3:00 P.M. Instruction Seminar, Vanderbilt Room, #3-4-5.
3:00 P.M. Instruction Seminar, Grand Ballroom.
4:00 P.M. Instruction Seminar, Vanderbilt Room, #3-4-5.
4:00 P.M. Instruction Seminar, Grand Ballroom.
6:00 P.M. Executives Dinner, Vanderbilt Room, #1.
8:00 P.M. First Congress Business Meeting — Congress Members Only — Grand Ballroom.

TUESDAY, August 26

8:00 A.M. Registration, Mezzanine, Inspection of Exhibits.
8:30 A.M. Instruction Seminar, Vanderbilt Room, #3-4-5.
8:30 A.M. Instruction Seminar, Grand Ballroom.
10:00 A.M. Scientific Program, Grand Ballroom.
12:00 Noon. Luncheon — Inspection of Exhibits.
12:15 P.M. Subscription Luncheon, Hydrotherapy Group, Vanderbilt Room, #3-4.
1:00 P.M. Scientific Films, Small Ballroom.
2:00 P.M. Formal Opening Session, Grand Ballroom.
4:30 P.M. Second Congress Business Meeting — Congress Members Only — Grand Ballroom.
6:30 P.M. Editorial Board Dinner, Vanderbilt Room, #1.

WEDNESDAY, August 27

8:00 A.M. Registration, Mezzanine — Inspection of Exhibits.
8:30 A.M. Instruction Seminar, Vanderbilt Room, #3-4-5.
8:30 A.M. Instruction Seminar, Grand Ballroom.
10:00 A.M. Scientific Program, Grand Ballroom.
12:00 Noon. Luncheon — Inspection of Exhibits.
12:30 P.M. Registry Board Luncheon (by invitation), Vanderbilt Room, #1.
1:00 P.M. Scientific Films, Small Ballroom.
2:00 P.M. Scientific Program, Grand Ballroom.
6:00 P.M. Cocktail Hour — Host, New York Society of Physical Medicine.
7:00 P.M. Annual Congress Dinner, Hendrik Hudson Room.

THURSDAY, August 28

8:00 A.M. Registration, Mezzanine — Inspection of Exhibits.
8:30 A.M. Instruction Seminar, Vanderbilt Room, #3-4-5.
8:30 A.M. Instruction Seminar, Grand Ballroom.
10:00 A.M. Scientific Program, Grand Ballroom.
12:00 Noon. Luncheon — Inspection of Exhibits.
12:15 P.M. Veterans Administration Personnel Luncheon, Hendrik Hudson Room.
1:00 P.M. Scientific Films, Small Ballroom.
2:00 P.M. Scientific Program, Grand Ballroom.
4:30 P.M. Board of Governors, Society, Vanderbilt Room, #1.
7:00 P.M. Society Dinner, Hendrik Hudson Room.

FRIDAY, August 29

8:00 A.M. Registration, Mezzanine — Inspection of Exhibits.
8:30 A.M. Instruction Seminar, Vanderbilt Room, #3-4-5.
8:30 A.M. Instruction Seminar, Grand Ballroom.
10:00 A.M. Board of Governors, Congress, Vanderbilt Room, #1.
10:00 A.M. Scientific Program, Grand Ballroom.
12:00 Noon. Luncheon.

EDUCATIONAL CONFERENCE

MONDAY, August 25 — 2:00 P. M.

Small Ballroom

Chairman — EARL C. ELKINS, Rochester, Minn.

1. University Sponsored Graduate Fellowship Training in the Medical Specialties.

Kendall Brooks Corbin, M.D. (by invitation), Associate Director, Mayo Foundation for Medical Education and Research, University of Minnesota Graduate School, Rochester, Minn.

2. Method of AMA Residency Approval.

Author to be announced.

3. Undergraduate Instruction in Physical Medicine and Rehabilitation.

Author to be announced.

4. Report of the Advisory Committee of the Council on Physical Medicine and Rehabilitation of the American Medical Association — Earl C. Elkins, M.D., Chairman.

GENERAL SCIENTIFIC SESSION

TUESDAY, August 26 — 10 A. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — WALTER M. SOLOMON, Cleveland.
Secretary — GEORGE M. PIERSOL, Philadelphia.

1. Studies on Anterior Poliomyelitis Patients with Respiratory Paralysis.

O. LEONARD HUDDLESTON, M.D., Clinical Professor of Physical Medicine, Department of Physical Medicine, University of Southern California, School of Medicine, Los Angeles.

Discussion: Hart E. Van Riper, M.D. (by invitation), New York, N. Y.

2. Scapular Fixation by Bracing in Serratus Anterior Palsy.

ALLEN S. RUSSEK, M.D., Assistant Professor of Physical Medicine and Rehabilitation, New York University College of Medicine, New York,

and

MORTON MARKS, M.D. (by invitation), Instructor, Department of Physical Medicine and Rehabilitation, New York University College of Medicine, New York.

Discussion: Odon F. von Werssowetz, M.D., Nashville, Tenn.

3. **The Role of Lordosis in Back Pain.**
HAROLD LEFKOE, M.D., Department of Physical Medicine and Rehabilitation, Philadelphia General Hospital, Philadelphia.
Discussion: Shelby Gamble, M.D., Columbus, Ohio.

4. **So-Called Spastic Flat Foot.**
ROBERT W. NEWMAN, M.D., Professor of Orthopedic Surgery, State University of Iowa Medical School, Iowa City, Iowa.
Discussion: Jerome Weiss, M.D., Brooklyn, N. Y.

5. **Final Results in Traumatic Cases Receiving Physical Therapy: By Improved Methods of First Aid and Safe Transportation.**
ROBERT C. HUGHES, M.D., Staff Surgeon, Chester County Hospital, West Chester, Pa.,
and
MILLARD CROLL, M.D. (by invitation).
Discussion: Solomon Winokur, M.D., New Orleans, La.

6. **The Influence of the Frequency of Muscle Stimulation on the Circulation in the Stimulated Extremity.**
KHALIL G. WAKIM, M.D. (by invitation), Professor of Physiology, Mayo Foundation, Rochester, Minn.
Discussion: Herbert W. Park, M.D., Fishersville, Va.

7. **Skin Temperature in Relation to Nerve Injuries in Man.**
HERBERT SHAPIRO, Ph.D. (by invitation), Assistant Professor of Physical Medicine, Graduate School of Medicine, University of Pennsylvania;
GEORGE M. PIERSOL, M.D., Professor of Medicine, Graduate School of Medicine, University of Pennsylvania,
and
EMERY K. STONER, M.D., Instructor in Physical Medicine, Graduate School of Medicine, University of Pennsylvania, Philadelphia.
Discussion: Glenn Gullickson, Jr., M.D. (by invitation), Minneapolis, Minn.

GENERAL SCIENTIFIC SESSION

TUESDAY, August 26 — 2 P. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — ROBERT L. BENNETT, Warm Springs, Ga.
Secretary — FRANCES BAKER, San Mateo, Calif.

OPENING OF THE 30TH ANNUAL SESSION

INVOCATION

The Reverend Charles P. Deems,
St. Bartholomew's Church, New York.

ADDRESSES OF WELCOME

John Garlock, M.D.,
President-Elect,
Medical Society of the County of New York.

Hans J. Behrend, M.D.,
President, New York Society of Physical Medicine.

1. **The Training of a Physiatrist.**
ROBERT L. BENNETT, M.D., Director of Physical Medicine, Georgia Warm Springs Foundation, Warm Springs, Ga.; Professor of Physical Medicine, Emory University Medical School, Emory University, Ga.

2. **The Present Status of Ultrasonic Therapy.**
J. F. K. LEHMANN, M.D. (by invitation), Fellow, Mayo Clinic, Rochester, Minn.
Discussion: Fritz Friedland, M.D., Framingham, Mass.

3. **Serum Neuritis: An Analysis of Sixteen Cases.**
ARTHUR L. WATKINS, M.D., Assistant Clinical Professor of Medicine, Harvard Medical School, and Chief of Physical Medicine, Massachusetts General Hospital, Boston.
Discussion: Joseph Moldaver, M.D. (by invitation), New York, N. Y.

4. **Rehabilitation of the Hand in Rheumatoid Arthritis.**
FRANCES BAKER, M.D., Director, Department of Physical Medicine, Community Hospital, San Mateo, Calif.
Discussion: Donald L. Rose, M.D., Kansas City, Kans.

5. **Rehabilitation in the Clinical Management of the Patient with Tuberculosis.**
EDWARD E. GORDON, M.D. (by invitation), Associate Professor of Rehabilitation Medicine, College of Physicians and Surgeons, Columbia University, New York.
Discussion: Sylvester S. Zintek, M.D., Martinsburg, West Va.

6. **The Use of the High Frequency Currents in Surgery.**
WILLIAM H. SCHMIDT, M.D., Associate Professor of Physical Medicine, Jefferson Medical College, Philadelphia.
Discussion: William Bierman, M.D., New York, N. Y.

GENERAL SCIENTIFIC SESSION

WEDNESDAY, August 27 — 10 A. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — WILLIAM B. SNOW, New York.
Secretary — DISRAELI KOBAK, Chicago.

ULTRASONIC SYMPOSIUM

1. **Temperatures Produced in Bone by Various Methods Used in Ultrasonic Therapy: An Experimental Study.**
LEONARD F. BENDER, M.D., Fellow in Physical Medicine, Mayo Foundation, Rochester;
JULIA F. HERRICK, Ph.D. (by invitation), Associate Professor of Experimental Medicine, Mayo Foundation, University of Minnesota Graduate School,
and
FRANK H. KRUSEN, M.D., Professor of Physical Medicine and Rehabilitation, Mayo Foundation, and Head of Section on Physical Medicine and Rehabilitation, Mayo Clinic, Rochester, Minn.

2. **Studies on Analgesic Effects of Ultrasonic Therapy.**
HARRY H. ROSENTHAL, M.D., Instructor in Medicine, New York University, New York.
Discussion of foregoing papers: Paul A. Nelson, M.D., Cleveland, Ohio.

3. **Ultrasonic Effects on Muscle, an Experimental Study.**
JEROME W. GERSTEN, M.D., Assistant Professor, Department of Physical Medicine and Rehabilitation, University of Colorado Medical Center, Denver.
Discussion: Herman J. Bearzy, M.D., Dayton, Ohio.

4. **Comparative Evaluation of Ultrasound and Ultra High Frequency Diathermy in Medicine.**
HERMAN P. SCHWAN, Ph.D. (by invitation), Assistant Professor of Physical Medicine, University of Pennsylvania, Graduate School of Medicine,
and
EDWIN L. CARSTENSEN, B.S., M.S. (by invitation), Research Associate in Electrical Engineering, University of Pennsylvania, Graduate School of Medicine, Philadelphia, Pa.
Discussion of foregoing papers: Thomas P. Anderson, M.D., Hanover, N. H.

5. **Evaluation of the Clinical Use of Ultrasonics.**
BRUCE B. GRYNBAUM, M.D., Director of Rehabilitation, Physical Medicine and Rehabilitation, Department of Hospitals, New York.

6. **Ultrasonics in Osteoarthritis.**
FERDINAND F. SCHWARTZ, M.D., Assistant Professor of Clinical Physical Medicine, Medical College of Alabama, Birmingham, Ala.
Discussion of foregoing papers: Ralph E. DeForest, M.D., Chicago, Ill.

GENERAL SCIENTIFIC SESSION

WEDNESDAY, August 27 — 2 P. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — FRANK H. KRUSEN, Rochester, Minn.
Secretary — ARTHUR L. WATKINS, Boston.

1. **Second John Stanley Coulter Memorial Lecture: Report on the International Congress of Physical Medicine.**
FRANK H. KRUSEN, M.D., Professor of Physical Medicine and Rehabilitation, Mayo Foundation, and Head of Section on Physical Medicine and Rehabilitation, Mayo Clinic, Rochester, Minn.

2. **Current Concepts of Electrotherapy in Peripheral Nerve Injuries.**
ELIAS M. THRONE, M.D. (by invitation), Resident in Physical Medicine, Letterman Army Hospital,
and
RAOUL C. PSAKI, M.D., Chief, Physical Medicine, Letterman Army Hospital, San Francisco, Calif.
Discussion: Stanley F. Radzyminski, M.D., Cleveland, Ohio.

3. **Prosthetic Training for Upper Extremity Amputees with Cineplasty.**
JOHN H. KUITERT, Lt. Col., MC, U.S.A., Chief, Physical Medicine Service, Walter Reed Army Hospital, Washington, D. C.
Discussion: John H. Aldes, M.D., Los Angeles, Calif.

4. **Coordination of Plastic Surgery and Physical Medicine in the Paraplegic Patient.**
GORDON S. LETTERMAN, M.D. (by invitation), Department of Surgery, George Washington University School of Medicine,
and
CHARLES S. WISE, M.D., Professor of Physical Medicine and Rehabilitation, George Washington University School of Medicine, Washington, D. C.
Discussion: Louis B. Newman, M.D., Chicago, Ill.

5. **Physiologic Responses to Generalized Heat Treatments.**
WALTER S. McCLELLAN, M.D., Associate Professor of Medicine, Albany Medical College, Albany, N. Y., and Medical Director, The Saratoga Spa, Saratoga Springs, N. Y.
Discussion: Hans J. Behrend, M.D., New York, N. Y.

6. **A Study of the Amplitude of Motor Unit Action Potentials.**
REX O. McMORRIS, M.D. (by invitation), Fellow in Physical Medicine, Mayo Foundation,
and
EDWARD H. LAMBERT, M.D. (by invitation), Assistant Professor of Physiology, Mayo Foundation, and Consultant in Physiology, Mayo Clinic, Rochester, Minn.
Discussion: H. Worley Kendell, M.D., Peoria, Ill.

7. **Fibrositic Nodules.**
HAROLD DINKEN, M.D., Professor and Head, Department of Physical Medicine and Rehabilitation, University of Colorado School of Medicine, Denver, Colo.
Discussion: John D. Currence, M.D., New York, N. Y.

8. **Function of Department of Physical Medicine in a Chronic Disease Research Institute.**
HENRY V. MORELEWICZ, M.D., Department of Physical Medicine and Rehabilitation, University of Buffalo, Chronic Disease Research Institute, Buffalo, N. Y.
Discussion: Herman J. Flax, M.D., Santurce, Puerto Rico.

GENERAL SCIENTIFIC SESSION

THURSDAY, August 28 — 10 A. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — A. B. C. KNUDSON, Washington, D. C.
Secretary — FRED B. MOOR, Los Angeles.

REHABILITATION SYMPOSIUM

1. **Rehabilitation of Hard of Hearing.**
HOWARD A. CARTER, M.E., Director of Biophysical Investigations, Council on Physical Medicine and Rehabilitation, American Medical Association, Chicago.
Discussion: Charles O. Molander, M.D., Chicago, Ill.

2. **Evaluation of Speech Training in the Rehabilitation of the Aphasic.**
SAMUEL S. SVERDLIK, M.D.
Discussion: Robert W. Boyle, M.D., Fort Thomas, Ky.

3. **Patient Evaluation by Wechsler Bellevue Test.**
EVERILL W. FOWLKS, M.D., Chief, Physical Medicine Rehabilitation Service, Veterans Administration Hospital, Portland, Ore.
Discussion: Oscar O. Selke, Jr., M.D., Houston, Tex.

4. **Rehabilitation of 120 Lobotomized Patients in a VA Hospital.**
CHARLES H. REAGAN, M.D., Chief, Physical Medicine and Rehabilitation, Veterans Hospital, Tuscaloosa, Ala.
Discussion: Jack Meislin, M.D., Montrose, N. Y.

5. **Work Program for the Disabled Housewife.**
EDITH L. KRISTELLER, M.D. (by invitation), Instructor in Physical Medicine and Rehabilitation, Department of Physical Medicine and Rehabilitation, New York University Medical School, New York.
Discussion: Florence I. Mahoney, M.D., Memphis, Tenn.

6. **Some Follow-Up Studies in Rehabilitation at the Institute for the Crippled and Disabled.**
MARION STRAUSS LESSER, M.A. (by invitation), Research Assistant in Medicine, Columbia University College of Physicians and Surgeons,
and
ROBERT C. DARLING, M.D., Professor of Physical Medicine, Columbia University College of Physicians and Surgeons, New York, N. Y.
Discussion: George D. Wilson, M.D., Asheville, N. C.

7. **Combined Use of Hydrotherapy and Sweating Cure in Certain Arthritis Problems.**
ADAM PEYLAN, M.D., Director, Physical Medicine and Rehabilitation, Rapha, Ltd., Tel-Aviv, Israel.
Discussion: Samuel Warshaw, M.D., New York, N. Y.

GENERAL SCIENTIFIC SESSION

THURSDAY, August 28 — 2 P. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — GORDON MARTIN, Rochester, Minn.
Secretary — NATHAN H. POLMER, New Orleans, La.

1. **Electrosurgery for the Treatment of Cutaneous Neoplasms.**
ANTHONY C. CIPOLLARO, M.D., Professor and Director, Department of Dermatology, New York Polyclinic Medical School and Hospital; Associate Professor of Clinical Medicine, Cornell University Medical College, New York.
Discussion: K. G. Hansson, M.D., New York, N. Y.

2. **Physical Medicine and Rehabilitation: Dynamic Effectiveness for Geriatric Patients.**
A. B. C. KNUDSON, M.D., Chief, Physical Medicine and Rehabilitation Division, Department of Medicine and Surgery, VA Central Office, Washington, D.C.
Discussion: Emmett M. Smith, M.D., Takoma Park, Md.

3. **Gait Studies of the Hemiplegia Patient and Their Clinical Applications.**
MORTON MARKS, M.D. (by invitation), Instructor, New York University College of Medicine, Department of Physical Medicine and Rehabilitation, New York.
Discussion: John C. Allen, M.D., Hartford, Conn.

4. **Foot Muscle Tester and Exerciser.**
WILLIAM BIERMAN, M.D., Assisting Clinical Professor, Physical Medicine and Rehabilitation, College of Physicians and Surgeons, Columbia University, New York.
Discussion: Ralph E. Worden, M.D., Columbus, Ohio.

5. **Assistive Activities for the Custodial Type Patient.**
MORTON HOBERMAN, M.D., Department of Physical Medicine and Rehabilitation, College of Physicians and Surgeons, Columbia University, New York,
and
ERBERT F. CICENIA, M.A., R.P.T. (by invitation), Director of Physical Rehabilitation, New York State Rehabilitation Hospital, West Haverstraw, N. Y.
Discussion: Samuel Sherman, M.D., Pittsburgh, Pa.

6. **Rehabilitation of the Amputee Patient.**
DONALD A. COVALT, M.D., Associate Professor, Department of Physical Medicine and Rehabilitation, New York University College of Medicine; Clinical Director, Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, New York.
Discussion: Keith C. Keeler, M.D., Cleveland, Ohio.

7. **Mineral Springs in the Commonwealth of Pennsylvania (A Field Survey).**
IGHO H. KORNBLUEH, M.D., Instructor in Physical Medicine, Graduate School of Medicine, University of Pennsylvania,
and
GEORGE M. PIERSOL, M.D., Professor of Medicine, Graduate School of Medicine, University of Pennsylvania, Philadelphia, Pa.
Discussion: F. A. Hellebrandt, M.D., Chicago, Ill.

8. **Assets and Deficits of Rehabilitation in the Treatment of the Patient with Rheumatoid Arthritis.**
EDWARD W. LOWMAN, M.D., Assistant Professor, Department of Physical Medicine and Rehabilitation, New York University College of Medicine, New York.
Discussion: Richard T. Smith, M.D., Philadelphia, Pa.

GENERAL SCIENTIFIC SESSION

FRIDAY, August 29 — 10 A. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — WILLIAM D. PAUL, Iowa City.
Secretary — WILLIAM BIERMAN, New York.

1. **The Clinical Approach to the Etiology of Cerebral Palsy.**
LEON GREENSPAN, M.D. (by invitation), Fellow in Physical Medicine and Rehabilitation, Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center,
and
GEORGE G. DEAVER, M.D., Professor of Clinical Rehabilitation and Physical Medicine, New York University College of Medicine, New York.
Discussion: Harriet E. Gillette, M.D., Atlanta, Ga.

2. **Intensive Exercise Program for Early Restoration in Knee Pathology and Surgery.**
C. DEWITT DAWSON, M.D., Chief, Physical Medicine and Rehabilitation Service, VA Center, Jackson, Miss.
Discussion: Frank J. Schaffer, M.D., Fort Thomas, Ky.

3. **Essential Points in Prescribing Therapeutic Exercises in the Management of Fractures.**
HANS KRAUS, M.D.,
and
ANN B. WHITTLESEY, M.D. (by invitation), Assistant, Department of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, New York.
Discussion: Miland E. Knapp, M.D., Minneapolis, Minn.

4. **Importance of Assistive Devices in Achieving Self-Sufficiency.**
LESLIE BLAU, M.D., Chief, Physical Medicine Rehabilitation Service, VA Center, Wadsworth, Kan.
Discussion: James W. Rae, Jr., M.D., Ann Arbor, Mich.

5. **Organization of a Rehabilitation Department in a Chronic Disease Hospital.**
SAMUEL G. FEUER, M.D., Instructor in Physical Medicine and Rehabilitation, Department of Medicine, State University Medical Center, New York.
Discussion: J. Wayne McFarland, M.D., Washington, D. C.

6. **Effect of Physical Modalities on Saphenous Circulation Time, With Use of a Radioactive Tracer.**
HARRY T. ZANKEL, M.D., Chief, Physical Medicine Rehabilitation Service, Crile Veterans Administration Hospital;
RICHARD CLARK, B.S. (by invitation), Physicist, Radioisotope Unit, Crile Veterans Administration Hospital,
and
REGINALD A. SHIPLEY, M.D. (by invitation), Associate Clinical Professor of Medicine, Western Reserve University and Director, Radioisotope Unit, Crile Veterans Administration Hospital, Cleveland, Ohio.
Discussion: Emil J. Hildenbrand, M.D., Washington, D. C.

7. **Physical Medicine and the So-Called Psychogenic Rheumatisms.**
IRVIN NEUFELD, M.D., Assistant Instructor in Orthopedic Surgery, New York Medical College, New York.
Discussion: Edward B. Shires, M.D., Norristown, Pa.

8. **The Place of Low Volt Currents in Hydrotherapy; Hydrogalvanism and Allied Currents.**
MILA KIRKPATRICK COVALT, M.D., Associate Clinical Professor of Medicine, Yale Medical School, New Haven, Conn.; Chief of Physical Medicine and Rehabilitation, State Veterans Home and Hospital-Hospital for Chronic Illness,
and
JAMES E. GRIFFIN, M.A., R.P.T. (by invitation), Department of Physical Medicine, Hospital for Chronic Illness, Rocky, Hill, Conn.
Discussion: Joseph M. Markel, M.D., Detroit, Mich.

9. **Oscillometric Evaluation of Arterial Blood Flow in Peripheral Vascular Diseases.**
BROR S. TROEDSSON, M.D., Chief, Department of Physical Medicine, Orange Memorial Hospital, Orange, N. J.
Discussion: Wilbur A. Selle, Ph.D., Los Angeles, Calif.

10. **Treatment of Spondylitis.**
BEN L. BOYNTON, M.D., Chief, Physical Medicine Rehabilitation Service, Veterans Administration Hospital, Houston, Texas;
LEWIS A. LEAVITT, M.D. (by invitation), Assistant Professor, Physical Medicine and Rehabilitation, Department of Neuropsychiatry, Baylor University College of Medicine;
ROXANA R. SCHNUR, M.D. (by invitation), Instructor in Physical Medicine and Rehabilitation, Baylor University College of Medicine,
and
HOWARD L. SCHNUR, M.D. (by invitation), Instructor in Physical Medicine and Rehabilitation, Department of Neuropsychiatry, Baylor University College of Medicine, Houston, Texas.
Discussion: Richard H. Dear, M.D., Phoenixville, Pa.

SCIENTIFIC EXHIBITS

Foot Muscle Tester and Exerciser. WILLIAM BIERMAN, M.D.

Progress in the Rehabilitation of the Aged. COMMISSION ON THE CARE AND TREATMENT OF THE CHRONICALLY ILL, AGED AND INFIRM, STATE OF CONNECTICUT.

Physical Medicine in Dermatology. ANTHONY CIPOLLARO, M.D.; RALPH E. DE FOREST, M.D.; FREDERIC T. JUNG, M.D., and HOWARD A. CARTER, M.E.

Integrated Rehabilitation Services at the Institute for the Crippled and Disabled. ROBERT C. DARLING, M.D.

Rehabilitation Procedures in Children with Physical Disabilities. GEORGE G. DEAVER, M.D.

Continuous Oxygen-Rich Aerosol for the Tracheotomized Respirator Patient. ROBERT DENTON, 1ST LT. USAF (MC), and JOSEPH N. SCHAEFFER, LT. COL. USAF (MC).

Peripheral Arterial Thrombosis and Embolism: Diagnosis and Management. SAMUEL FELDMAN, M.D.; DAVID FRIEDMAN, M.D.; MURRAY MAHL, M.D., and DAVID KERSHNER, M.D.

Rehabilitation of the Paraplegic. SAMUEL G. FEUER, M.D.

Arthritis. SIGMUND FORSTER, M.D.

The Care of the Hemiplegic Infant and Child with Tuberculous Meningitis. JEROME GERSTEN, M.D.; RHODA GERSTEN, B.A., and EVELYN MAY, R.P.T.

Improvised Rehabilitation Equipment. HERBERT KENT, M.D., and E. R. GANZA.

Rehabilitation in Otolaryngology. CLAIR M. KOS, M.D., and JACQUELINE KEASTER.

Gas Flow Rates During Respiraton. WILLIAM G. KUBICEK, Ph.D.

The "X-Ray Negative" Shoulder. HAROLD LEFKOE, M.D.

Management of the Poliomyelitis Patient with Respiratory Difficulty. NATIONAL FOUNDATION FOR INFANTILE PARALYSIS.

Building Happy, Useful Lives Through Easter Seal Services. NATIONAL SOCIETY FOR CRIPPLED CHILDREN AND ADULTS.

Table for Vertebral Elongation. EUGENE NEUWIRTH, M.D.

Physical Medicine and Rehabilitation in Acute Myocardial Infarction. L. B. NEWMAN, M.E., M.D.; L. A. BAKER, M.D.; M. P. ANDREWS, B.S., P.T., and M. O. KOBLISH, B.S., O.T.R.

Rim Fracture of Humeral Head. ROBERT W. NEWMAN, M.D.

Miniature Equipment for Cerebral Palsy. M. A. PERLSTEIN, M.D.; HARRY BARNETT, M.D., and JEROME FINDER, M.D.

Ultrasonic Scanning of Osteoporotic Bones. HARRY H. ROSENTHAL, M.D.

Rehabilitation of the Hemiplegic Housewife. HOWARD A. RUSK, M.D.; EDITH L. KRISTELLER, M.D., and JOSEPH G. BENTON, M.D.

Functional Shoulder and Upper Extremity Brace-Apparatus. ROBERT B. WALLACE, M.D.

Prosthetic Training for the Upper Extremity Amputee: Special Problems for Cineplasty. WALTER REED ARMY HOSPITAL.

Paralysis Agitans. MAX WEINSTEIN, M.D.

Traction Table. EUGENE H. WEISSENBERG, M.D.

Self-Help Devices for Rehabilitation. MURIEL E. ZIMMERMAN, O.T.R., and HOWARD A. RUSK, M.D.

TECHNICAL EXHIBITS

AMERICAN HOSPITAL SUPPLY CORPORATION.

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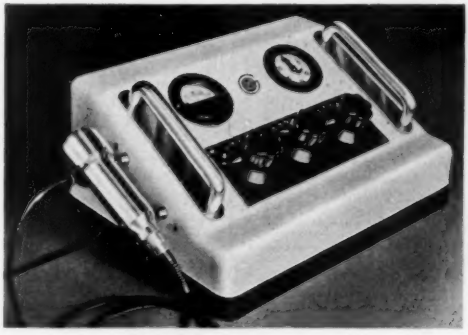

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MEETINGS OF INTEREST TO THOSE IN THE FIELD OF PHYSICAL MEDICINE AND REHABILITATION

In this column will be published information about meetings of interest to those in the field of physical medicine New data should be sent promptly to the office of the ARCHIVES, 30 North Michigan Avenue, Chicago 2, Illinois.

American Congress of Physical Medicine. — 30th Annual Session, The Roosevelt, New York, New York, August 25, 26, 27, 28, 29, 1952. Walter J. Zeiter, M.D., Chairman, Convention Committee, 30 North Michigan Ave., Chicago 2.

New York Society of Physical Medicine. — Meetings, first Wednesday. Madge C. L. McGuinness, M.D., Secretary, 48 E. 62nd St., New York 21, N. Y.

The National Society for Crippled Children and Adults, Inc. — 1952 annual convention, Fairmont Hotel, San Francisco, October 26, 27, 28 and 29, 1952. Lawrence J. Linck, Executive Director, 11 South La Salle Street, Chicago 3.

American Occupational Therapy Association. — Annual Convention, August 9-16, 1952, Milwaukee, Wisconsin, Hotel Schroeder. Marjorie Fish, OTR, Executive Director, 33 West 42nd Street, New York 18, N. Y.

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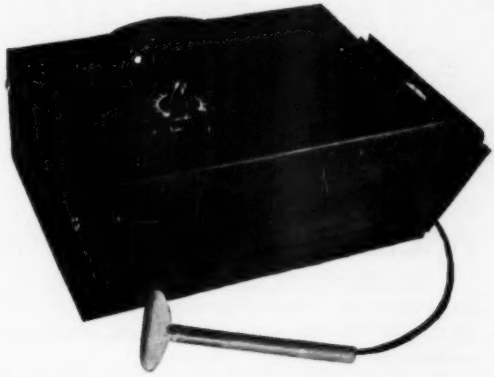

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PHYSICAL MEDICINE AND REHABILITATION **

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Hospitals, 43 Assistant Residencies and Residencies, 87

Name of Hospital	Location	Chief of Service	Inpatients Treated	Number of Treatments	First Year Residencies Offered*	Total Residencies Offered*	Beginning Stipend (Month)
UNITED STATES ARMY							
Letterman Army Hospital★	San Francisco	R. C. Paaki	3,330	74,961	—	—	—
Fitzsimons Army Hospital★	Denver	H. B. Luscombe	19,403	258,913	1	4	—
Army Medical Center★	Washington, D. C.	J. H. Kuitert	6,755	263,456	3	5	—
VETERANS ADMINISTRATION							
Veterans Admin. Hospital★[1]	Long Beach, Calif.	R. N. Nyquist	10,922	195,816	1	2	—
†Veterans Admin. Hospital[1]	Fort Logan, Colo.	F. J. Fricke	907	36,326	—	—	—
Veterans Admin. Hospital	Hines, Ill.	L. B. Newman	5,665	450,711	—	—	—
Veterans Admin. Hospital[1]	Wadsworth, Kans.	L. Blau	3,169	192,760	—	—	—
Veterans Admin. Hospital[1]	Framingham, Mass.	F. Friedland	7,000	210,000	1	3	—
Veterans Admin. Hospital[1]	Jefferson Bks., Mo.	E. H. Weissenb'g	2,215	77,491	1	1	—
Veterans Admin. Hospital[1]	New York City	A. S. Abramson	13,819	314,026	3	9	—
Veterans Admin. Hospital[1]	Cleveland	H. T. Zankel	6,414	81,929	1	1	—
†Veterans Admin. Hospital	Portland, Ore.	E. W. Fowlks	4,954	110,420	1	1	—
†Veterans Admin. Hospital[1]	Aspinwall, Pa.	S. Machover	2,516	106,131	—	1	—
Veterans Admin. Hospital★[1]	Houston, Tex.	B. L. Boynton	1,582	6,894	1	1	—
NONFEDERAL							
Los Angeles County Hospital★[1]	Los Angeles	E. Austin	—	91,836	—	1	165
White Memorial Hospital★	Los Angeles	F. B. Moor	195	—	1	1	120
University of Colorado Medical Center							
Colorado General Hospital★[1]	Denver	H. L. Dinken	2,580	45,876	1	2	75
State of Connecticut Vet. Home & Hosp.	Rocky Hill, Conn.		—	—	2	3	—
Emory University Hospital★	Emory Univ., Ga.	R. L. Bennett	1,719	10,473	1	1	50
Georgia Warm Springs Foundation	Warm Springs, Ga.	R. L. Bennett	973	104,401	1	3	250
Cook County Hospital★[1]	Chicago	D. Kobak	7,501	37,516	—	—	—
Michael Reese Hospital★[1]	Chicago	C. O. Molander	2,254	19,589	1	1	25
Northwestern University Medical Center	Chicago		13,590	40,962	—	—	—
Research and Educational Hospitals★[1]	Chicago	H. W. Kendell	5,688	11,769	1	3	55
University of Kansas Medical Center★[1]	Kansas City, Kans.	D. L. Rose	2,456	42,310	1	1	100
Massachusetts General Hospital★	Boston	A. L. Watkins	2,925	31,999	0	9	41.66
University Hospital★	Ann Arbor, Mich.		—	—	—	—	—
University of Minnesota Hospital★[1]	Minneapolis	M. Knapp	20,409	29,436	4	4	—
Mayo Foundation	Rochester, Minn.	F. H. Krusen	—	—	2	6	135
Barnes Hospital★	St. Louis	S. Mead	9,759	9,759	0	1	—
†Bellevue Hosp., Div. III, N. Y. Univ.★[1]	New York City	H. A. Rusk	4,058	116,705	—	7	80
Goldwater Memorial Hospital★	New York City	M. Dacso	733	50,706	1	2	80
Hospital for Joint Diseases★[1]	New York City	J. Weiss	—	94,631	1	1	40
Hospital for Special Surgery	New York City	K. G. Hansson	20,806	40,810	1	1	160
Mount Sinai Hospital★[1]	New York City	W. Bierman	11,942	36,970	1	1	50
New York City Hospital★[1]	New York City	F. K. Safford, Jr.	1,138	41,088	1	1	130
†Presbyterian Hospital★[1]	New York City	W. B. Snow	35,845	103,546	1	1	200
St. Luke's Hospital★[1]	New York City	R. Muller	900	98,954	1	1	40
†Rehabilitation Hospital	W. Haverstraw, N. Y.	M. Hoberman	5,868	408,371	1	1	225
Cleveland Clinic Hospital[1]	Cleveland	W. J. Zeiter	17,062	38,475	1	4	—
Hospital of the University of Pa.★[1]	Philadelphia	G. M. Piersol	1,636	25,639	0	1	—
Philadelphia General Hospital★[1]	Philadelphia	A. A. Martucci	2,827	25,733	1	1	75
Medical College of Virginia—Hosp. Div.★[1]	Richmond, Va.	W. J. Lee	4,575	40,327	—	—	46.50

The star (★) indicates hospital approved for intern training.
The dagger (†) indicates temporary approval.
[1] Residencies open to women.
** Reprinted in part J. A. M. A. 147:440 (September 29) 1951.

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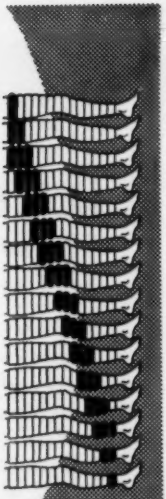

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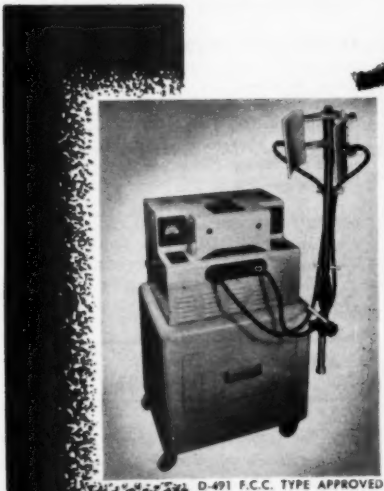

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[1]Handbook of Physical Medicine and Rehabilitation, S. L. Osborne, p. 245. Published for the A.M.A. The Blakiston Co., Philadelphia, 1950.

[2]Svien, H. J., and Dodge, H. W., Jr.: Peripheral Nerve Injuries, GP 5:57 (Mar.) 1952.

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V = velocity

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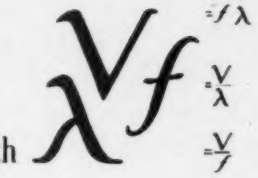

$= f\lambda$

$= \frac{V}{\lambda}$

$= \frac{V}{f}$

SUBJECT: **Ultrasonics**

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